

**2006 Data Summary  
Missouri Nutrition Surveillance System**

# **Pregnancy Nutrition Surveillance**



**Missouri Department of Health and Senior Services**

## **PREFACE**

This document summarizes selected key maternal health indicators of women participating in the Missouri WIC Program in 2006, which contributed to the Missouri Pregnancy Nutrition Surveillance System in 2006.

Missouri Department of Health and Senior Services

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## EXECUTIVE SUMMARY

Maternal health risk factors that affect the mother and her birth outcome include maternal prepregnancy weight, weight gain during pregnancy, and anemia (low hemoglobin/hematocrit) status. Behavioral factors such as tobacco use and exposure and time of enrollment in prenatal care can influence birth outcome and the mother's health as well.

The Centers for Disease Control and Prevention (CDC) Pregnancy Nutrition Surveillance System (PNSS) has monitored health and behavioral risk factors among low-income, pregnant, prenatal, and postpartum women enrolled in federally funded public health programs in participating states since 1979. The Missouri 2006 PNSS includes data from only one source, the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). The data included complete information on prenatal and postpartum records with demographics, health and behavior risk factors, and infant birth outcomes.

In 2006, the largest proportion of PNSS population in Missouri was Non-Hispanic White women. The Hispanic portion of the population has been increasing from 1997 to 2006. Women age 20-29 years made up the largest proportion of Missouri PNSS population in 2006. Approximately 65% of the Missouri PNSS participants in 2006 had high school or higher education. Two thirds of PNSS participants were at income level 0-100% of the federal poverty level. A small number of participants reported being migrants.

Prepregnancy weight status is a determinant of weight gain during pregnancy and birthweight. About 45% of Missouri 2006 PNSS participants reported being overweight and obese during the prepregnancy period. From the perspective of race/ethnicity, Non-Hispanic Black women were more likely to be overweight before pregnancy than Non-Hispanic White and Hispanic women, while Asian/Pacific Islander women were more likely to be underweight before pregnancy. From the perspective of age, women who were 30 years or older were more likely to be overweight before pregnancy, while women who were 17 years or younger were more likely to be underweight before pregnancy.

Adequate maternal weight gain, based on prepregnancy weight status, is considered to be a major determinant of birthweight, as well as infant morbidity and mortality. Even with improved access to nutritious foods and nutrition education, approximately two-thirds of women participating in 2006 Missouri PNSS showed inadequate (greater than ideal or less than ideal) gestational weight gain. The Asian/Pacific Islander women were more likely to gain less than ideal weight, while American Indian/Alaskan Native, Non-Hispanic White, and Non-Hispanic Black women were more likely to gain greater than ideal weight during pregnancy. Approximately one third of Missouri PNSS participants in the 15-17, 18-19, 20-29, and 30-39 age groups gained ideal gestational weight.

Pregnant women are at higher risk for iron deficiency anemia because of the increased iron requirements of pregnancy. The rate of anemia (low hemoglobin/hematocrit) in the third trimester of pregnancy and postpartum among PNSS participants in Missouri for the last 10 years has shown no improvement. Non-Hispanic Black women and 15-19 years old participants were more likely to have low hemoglobin/hematocrit during the 3<sup>rd</sup> trimester of pregnancy and postpartum.

Pregnancy outcomes are better if prenatal care begins in the first trimester of pregnancy. From 1997-2006, the majority of women in Missouri PNSS received medical care during the first trimester of pregnancy. In 2006, a higher percentage of Missouri PNSS women were enrolled in WIC during the first trimester of pregnancy, than in the second and third trimesters and post partum.

Smoking during pregnancy is associated with an increased risk of several poor birth outcomes including low birthweight. From 1997-2006, more than one third of women in Missouri PNSS smoked 3 months prior to pregnancy and about one fourth smoked in the last 3 months of pregnancy. Race/ethnicity and educational level had strong impacts on participants' smoking behavior. Non-Hispanic White participants had the highest rates of smoking, while Asian/Pacific Islander participants had the lowest rates for both smoking 3 months prior to and the last 3 months of pregnancy. The prevalence of women who smoked 3 months prior to pregnancy and during the last 3 months of pregnancy were the highest among participants with less than a high school education.

In the Missouri PNSS population, women who were underweight before pregnancy and those who gained less than ideal gestational weight were more likely to deliver a low birthweight baby. Younger women (< 15 years) and Non-Hispanic Black women had the highest percentages of low birthweight infants. American Indian/Alaskan Native women and Hispanic women, as well as women age 30 years and over, were at higher risk of having a high birthweight infant. The 10-year trend in high birthweight demonstrates a slight decline in the percentage of babies born overweight.

Risk factors for preterm delivery, according to Missouri 2006 PNSS data, include being underweight before pregnancy, gaining less than ideal weight during pregnancy, being in the age groups of younger than 15 years and 40 years or older. Non-Hispanic Black women were more likely to have a preterm baby, compared to all other racial and ethnic groups.

In Missouri PNSS 2006, the proportion of women who initiated breastfeeding increased by about ten percentage points from 1997. Over two-thirds of Hispanic women, two-thirds of women with greater than high school education, and more than one half of women age 20 years and older initiated breastfeeding in 2006.

## INTRODUCTION

The Pregnancy Nutrition Surveillance System (PNSS) is a program-based surveillance system that monitors maternal health and behavioral indicators associated with birth outcomes among low-income pregnant women participating in federally funded maternal and child health programs.

In 2006, Missouri PNSS used data from the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). The number of records accepted for the Missouri PNSS in 2006 was 45,403, which was slightly lower than in 2005 (46,507). Records analyzed by the Centers for Disease Control and Prevention (CDC) consisted of 9.3% prenatal records, 20.3% postpartum records, and 70.5% complete records. Data were contributed by 169 WIC clinics, which collected data on demographic, health, and behavioral indicators from women during prenatal and postpartum clinic visits.

Demographic data collected included maternal race/ethnicity, age, educational level, poverty level and migrant status. Data on participation in food and medical assistance programs (e.g., Food Stamp Program or Medicaid) were collected as well.

In PNSS, indicators on which data were collected include maternal health and behavioral indicators and infant health indicators. Maternal health indicators consisted of prepregnancy weight, gestational weight gain and anemia status. The behavioral indicators assessed were smoking, WIC enrollment, and start date of medical care. Infant health indicator data included birthweight, preterm birth, full term low birthweight, and breastfeeding initiation.

CDC provided states participating in PNSS with a summary of trends on some indicators. In addition, CDC generated combined 3-year tables for WIC clinics and counties that had less than 100 records available after exclusions. The combined 3-year tables contain 3-year average rates on maternal demographic indicators, maternal health and behavioral indicators, and infant health indicators by clinic and county. Information from the combined 3-year tables was used to create maps showing rates on the most important indicators (Appendices 1-12).

### Limitations of the Pregnancy Nutrition Surveillance System

In Missouri, only the WIC program contributed to the PNSS, so the Missouri PNSS population does not represent all low-income women in the state (applicants must meet specific income guidelines and must be at nutritional risk to participate in WIC). Since not all states in the country participate in the PNSS, the “national” data do not reflect all such women in the United States. In addition, large demographic and other differences can exist between or among states that participate in PNSS. Other limitations relate to continuity of service and information tracking and reporting. Some women served by WIC in Missouri during the pregnancy did not participate in WIC after delivery. Other women moved into or out of a service area while pregnant. Also, since women came to clinics at different times during and after their pregnancies, some women’s records were not complete when they were compiled and sent to CDC. Another complication was that CDC did not analyze data for any clinic or county reporting less than 100 cases.

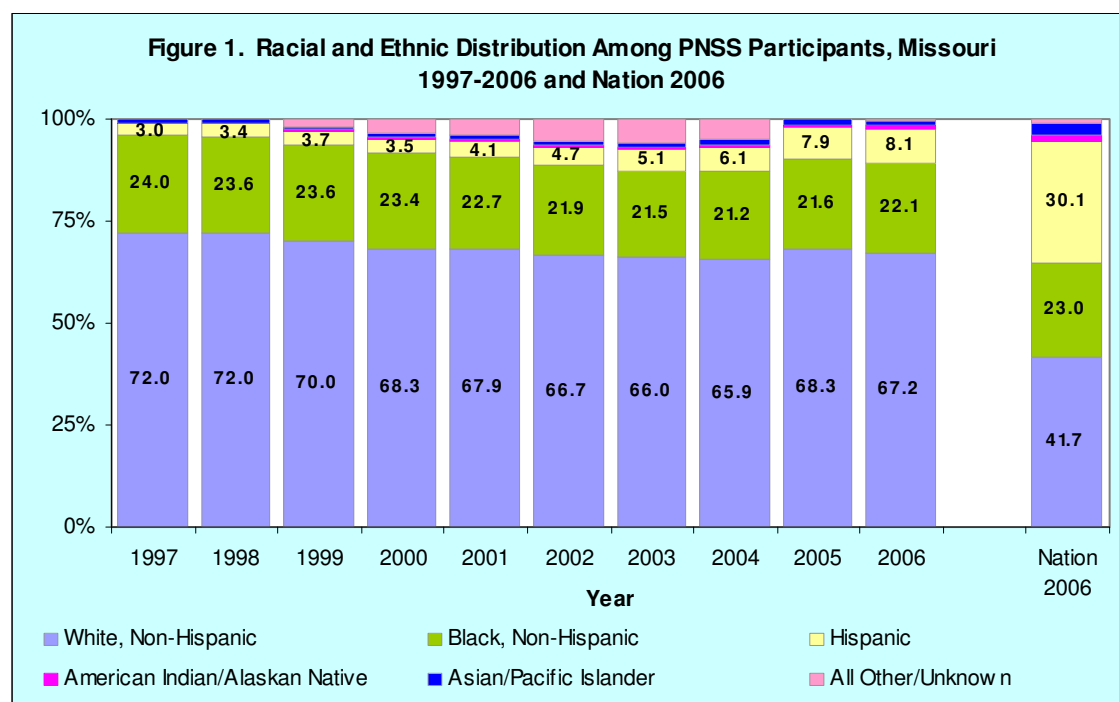
Nevertheless, PNSS is a unique data set in that it is the largest, most diverse (racially, ethnically, and geographically) data set available on low-income pregnant women in the nation.

The contribution of only WIC data to the PNSS in Missouri allows easier application of the conclusions and recommendations to WIC participants. Thus, it helps determine risk factors and is used to enhance planning interventions that have the potential to decrease infant mortality and poor birth outcomes among the state's low-income populations at health risk.

## MATERNAL DEMOGRAPHIC CHARACTERISTICS

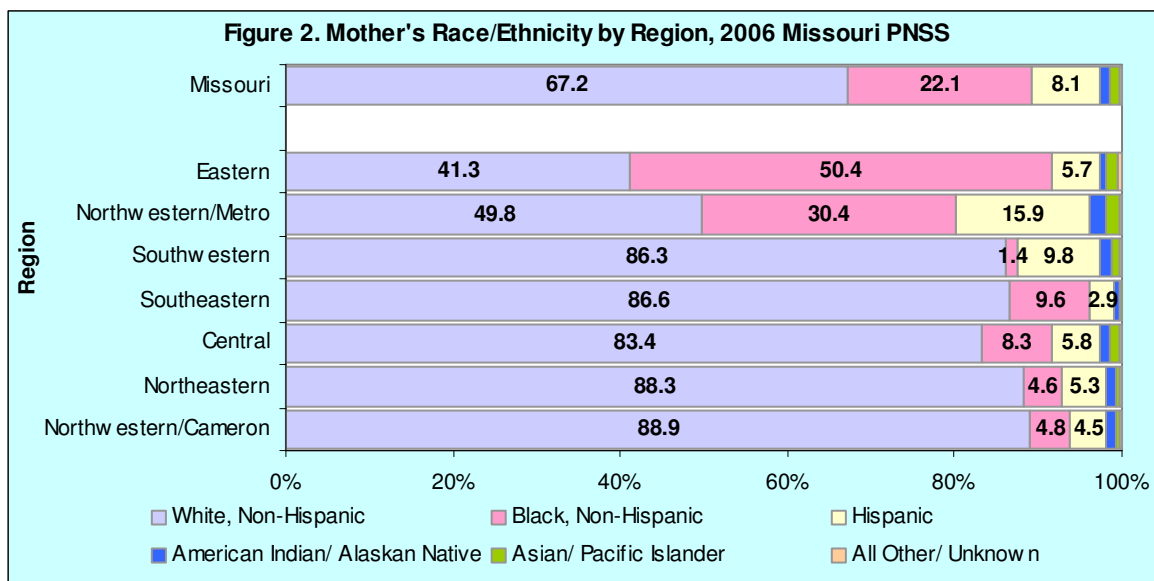
### Race/Ethnicity

Race/Ethnicity data were analyzed because differences observed in racial and ethnic groups may reflect differences in their susceptibility or exposure to disease or a health problem, or the persistence of that disease or health problem.



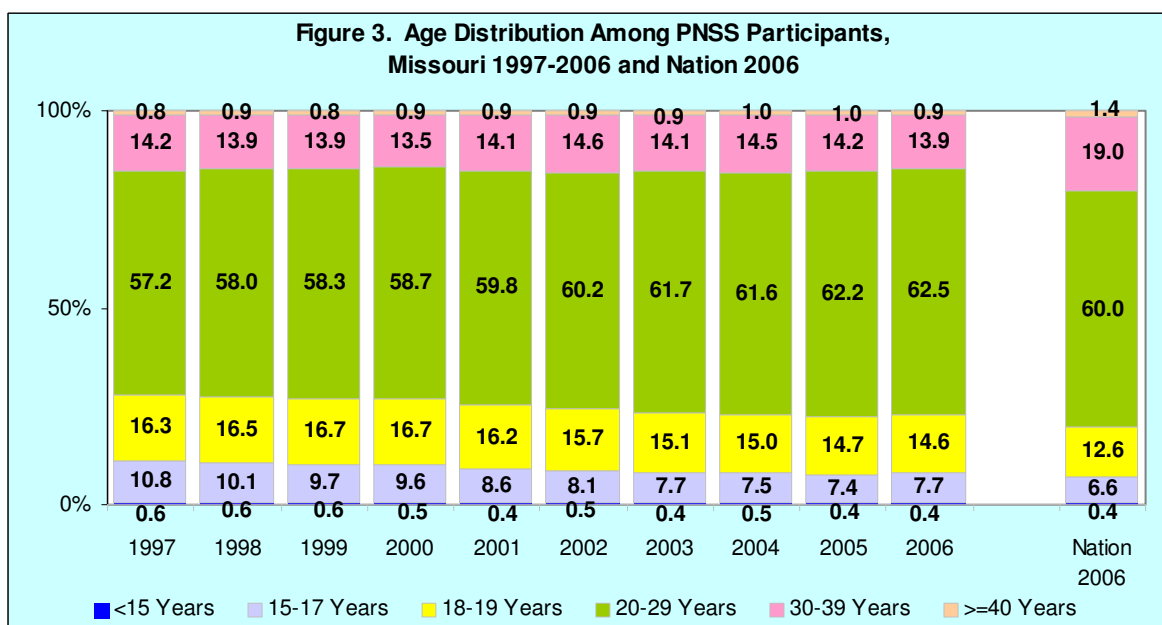
In Figure 1, a majority of the Missouri 2006 PNSS population included 67.2% Non-Hispanic White women, 22.1% Non-Hispanic Black women, and 8.1% Hispanic women. During the past 10 years, the percentage of Hispanic women in Missouri PNSS has increased from 3.0% to 8.1%. In the National 2006 PNSS, 41.7% of the participants were Non-Hispanic White, 23.0% were Non-Hispanic Black, and 30.1% were Hispanic. The major difference between the National PNSS and the Missouri PNSS was that Missouri had a greater proportion of Non-Hispanic White women and the Nation had a greater proportion of Hispanic women.

The racial and ethnic disparities among metropolitan and relatively rural regions in Missouri PNSS were very large. For example, in the Northwestern/Cameron region, the proportion of Non-Hispanic White women was 88.9%, while in the Eastern region it was 41.3%. The region with the highest percentage of Hispanic women was Northwestern/Metro (15.9%). In the Eastern region, half of all PNSS participants were Non-Hispanic Black women, while in the Southwestern region, only 1.4% were Non-Hispanic Black women (Figure 2).

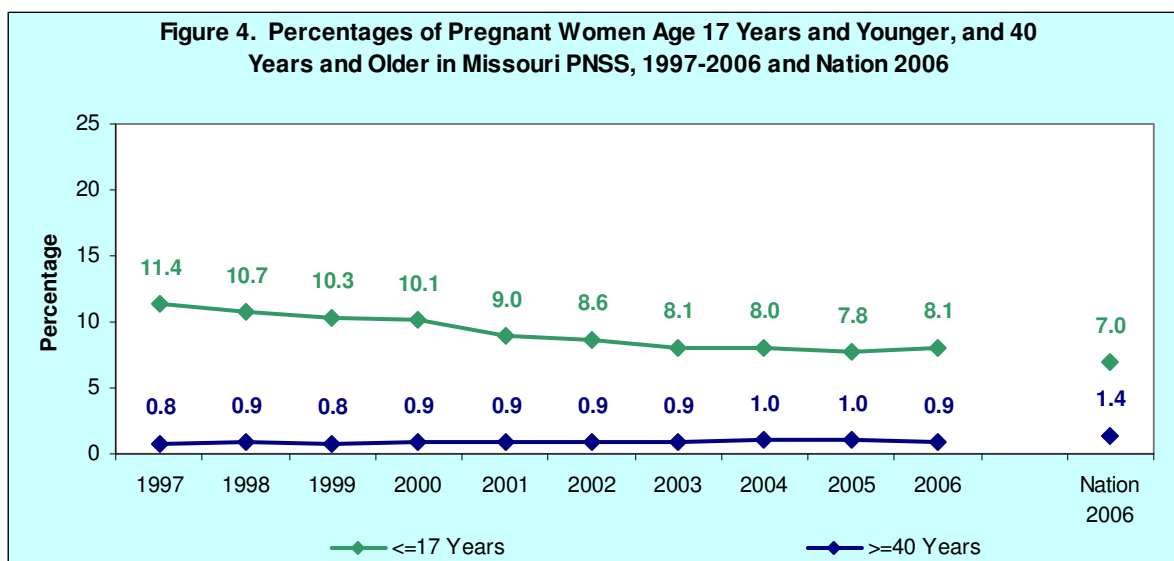


### Age

The age of the mother can be considered a risk factor because the rates of some indicators vary with age. In Figure 3, 0.4% of women participating in the 2006 Missouri PNSS were younger than 15 years, 7.7% were in the 15-17 years age group, 14.6% were in the 18-19 years age group, 62.5% were in the 20-29 years age group, 13.9% were in the 30-39 years age group, and 0.9% were 40 years and older.





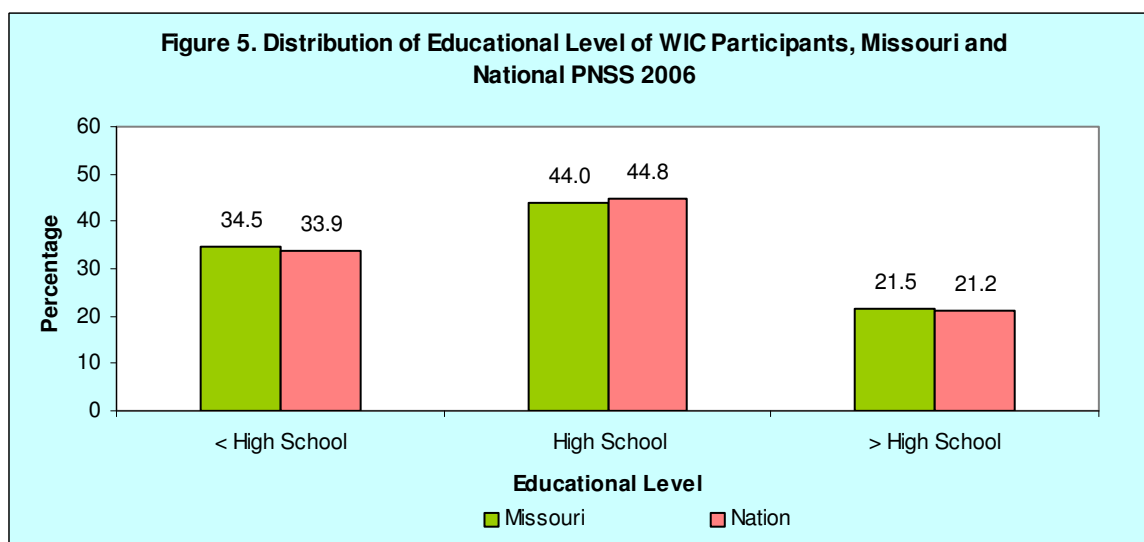


Note: Scale was set up from 0% to 25% to show the percentages in more detail. It is advised that data in Missouri and the nation not be compared directly, since they had different distributions on race/ethnicity.

Teens (17 years and younger) and older women (40 years and older) were at greatest risk of poor birth outcomes [1] [2]. Figure 4 shows that in the Missouri 2006 PNSS, 8.1% of pregnant women were less than 17 years while only 0.9% of them were older women. From 1997 to 2006, the proportion of pregnant teens in this age group in Missouri PNSS decreased from 11.4% to 8.1%, while the proportion of pregnant women who were 40 years and older has remained fairly stable.

### Education

Educational level among PNSS participants can be used as an indirect measure for socioeconomic status. Also, educational level can be important in relation to indicators, such as smoking habits and breastfeeding initiation. In Figure 5, out of the Missouri 2006 PNSS participants, 21.5% had completed greater than high school education, 44.0% had completed high school, and 34.5% had not received a high school education.



Note: Scale was set up from 0% to 60% to show the percentages in more detail.

The percentage of women with high school and greater than high school education participating in the Missouri 2006 PNSS was similar to the average of all states contributing to the PNSS in 2006.

### Poverty Level/Migrant Status

The majority (69.2%) of PNSS participants in Missouri in 2006 reported household income at 0-100% of the federal poverty level, while 29.4% reported household income at 101-200% of the federal poverty level. Nationally, 69.6% of all women participating in the 2006 PNSS were at household income levels less than or equal to 100% of the federal poverty level, and 28.4% reported household incomes at 101-200% of the federal poverty level.

A small number (23) of the Missouri PNSS participants reported that they were migrants in 2006, compared to 7,608 among PNSS participants in all states participating in the surveillance system in 2006.

## **MATERNAL HEALTH AND BEHAVIORAL HEALTH INDICATORS**

### Prepregnancy Weight Status<sup>1</sup>

Prepregnancy weight is an indicator of the nutritional status of a woman before she becomes pregnant and is a major factor affecting birth weight and therefore, health of the newborn and the mother. Prepregnancy underweight can be a determinant of low birthweight, preterm, and full term low birthweight, while prepregnancy overweight and obesity can be a determinant of delivery of a high birthweight infant and cesarean section delivery. An association between prepregnancy weight and stillbirth has been reported, with the lowest risk among normal weight women and the highest risk among overweight women [3].

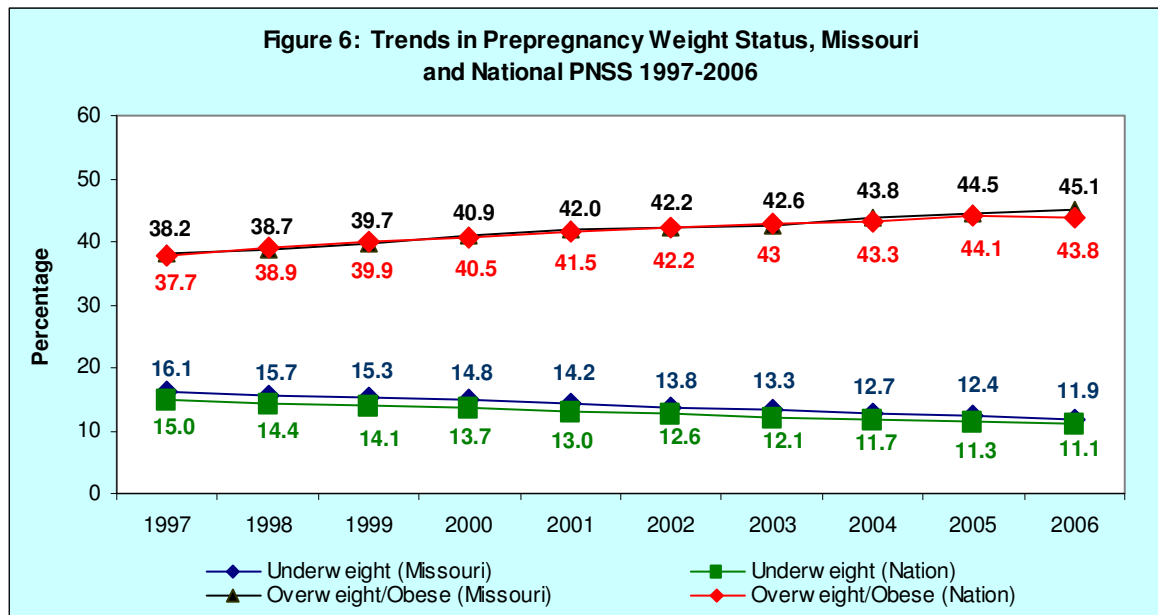
In the PNSS, prepregnancy weight status was determined by the body mass index (BMI<sup>2</sup>). In WIC clinics, self-reported prepregnancy weight and measured height are used to calculate prepregnancy BMI and then, according to the prepregnancy BMI, women are classified into one of four weight categories specified by the Institute of Medicine: underweight, normal weight, overweight, and obese [4].

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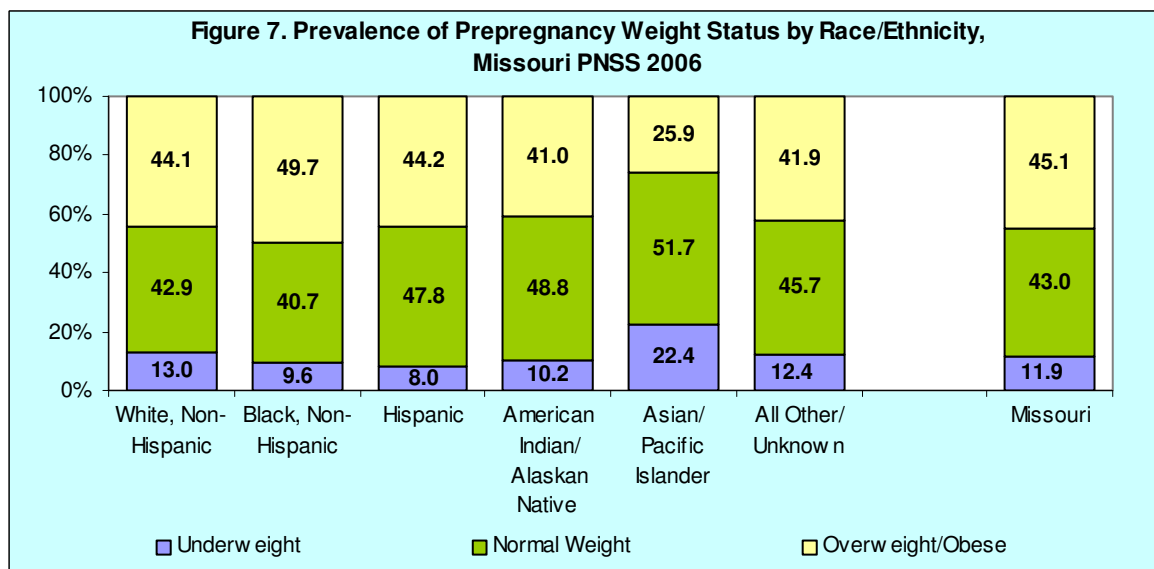
<sup>1</sup> Refer to the maps in [Appendix 1](#) to see prevalence of prepregnancy underweight by county, and [Appendix 2](#) for prevalence of prepregnancy overweight by county (Missouri PNSS 2004-2006 combined years).

<sup>2</sup> BMI uses a mathematical formula that takes into account of both a person's height and weight. BMI equals a person's weight in kilograms divided by height in meters squared ( $BMI = \text{kg}/\text{m}^2$ ).

In Figure 6, the percentage of women in the Missouri PNSS with low prepregnancy weight has been decreasing from 16.1% in 1997 to 11.9% in 2006. By contrast, the prevalence of prepregnancy overweight/obese has been increasing from 38.2% to 45.1% during the same time period.

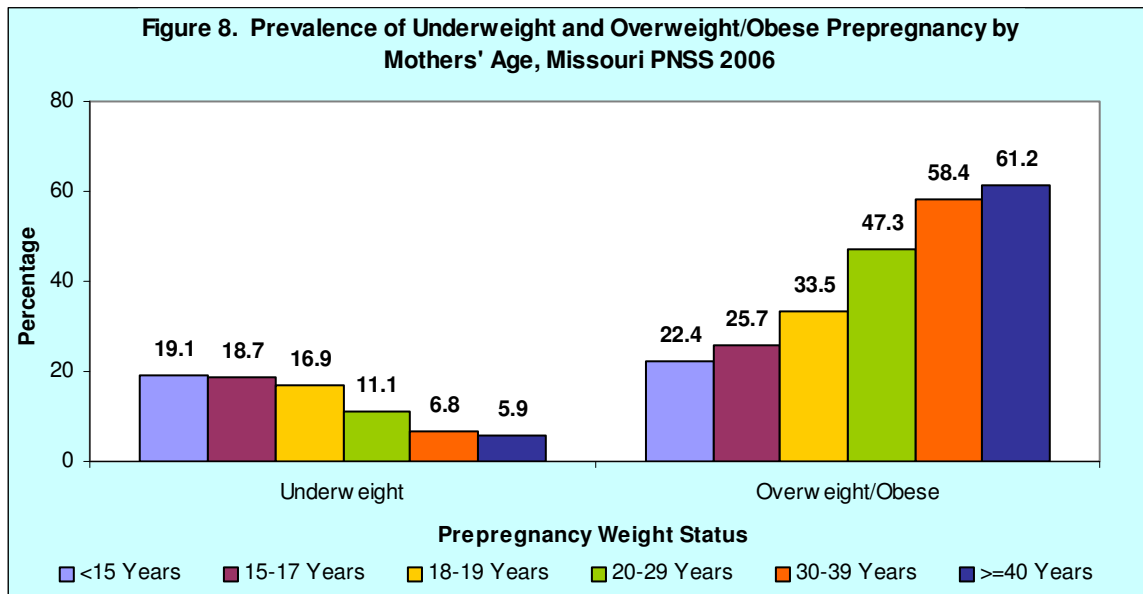


Note: Scale was set up from 0% to 60% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.



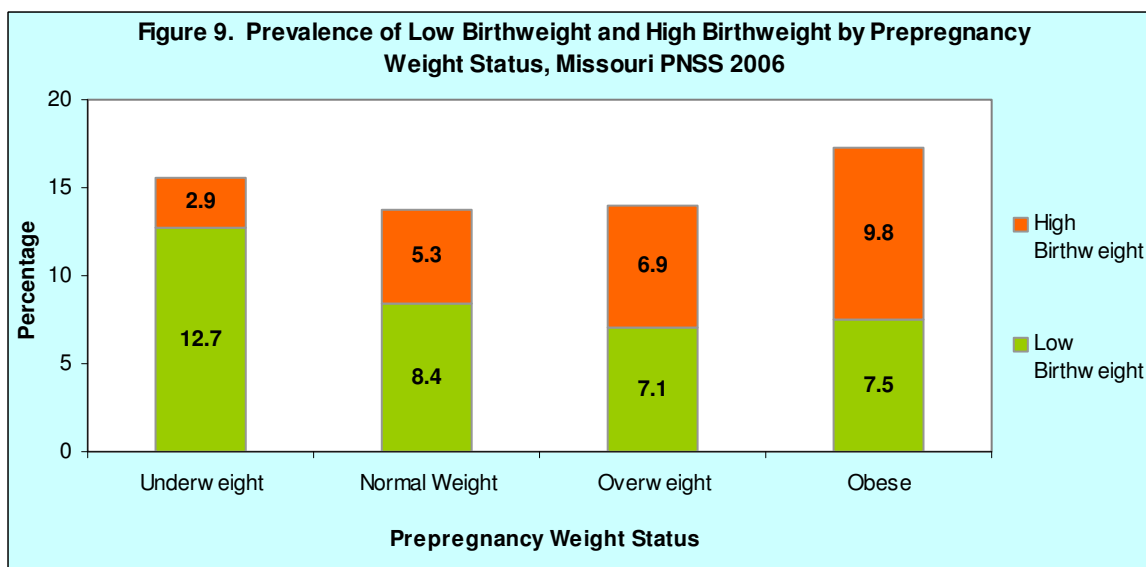
In the Missouri 2006 PNSS, the highest percentage of underweight prior to pregnancy (22.4%) was among Asian/Pacific Islander women (Figure 7). Also, Asian/Pacific Islander women were more likely to have normal weight during the prepregnancy period (51.7%) compared to women of other racial and ethnic groups. Non-Hispanic Black participants in 2006 were more likely to be overweight/obese (49.7%) before pregnancy and less likely to have normal weight

(40.7%) prior to pregnancy. The Hispanic race/ethnicity had the lowest percentage of women who were underweight (8.0%) prior to pregnancy.



Note: Scale was set up from 0% to 80% to show the prevalence in more detail.

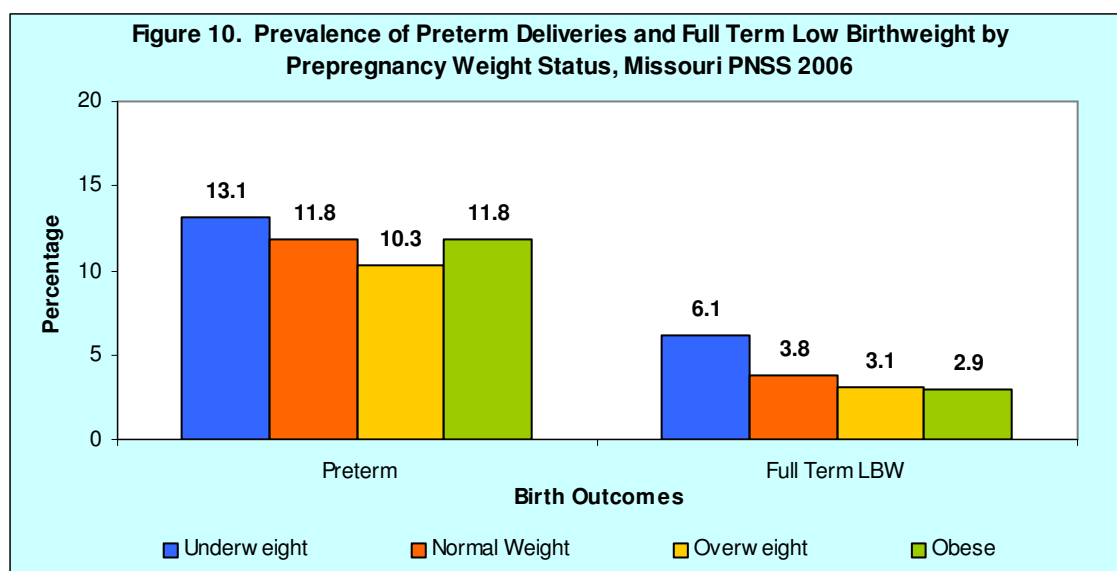
In Figure 8, women age 19 years and younger were more likely to be underweight before pregnancy. Prepregnancy overweight prevalence was over 50% among women 30 years and older. The Missouri 2006 PNSS prepregnancy underweight and overweight rates showed that the older a woman was, the more likely she would be overweight before pregnancy.



Note: Scale was set up from 0% to 20% to show the prevalence in more detail.

In the Missouri 2006 PNSS, women who were underweight before pregnancy were more likely to deliver a low birthweight baby (12.7%) compared with women who were normal weight, overweight, and obese (8.4%, 7.1%, and 7.5%, respectively) (Figure 9). Women who were obese before pregnancy were more likely to have a high birthweight infant (9.8%) compared with those who were normal weight (5.3%).

In Figure 10, the prevalence of delivering a preterm or full term low birthweight (LBW) baby was higher among women who were underweight prior to pregnancy (13.1% of preterm deliveries and 6.1% of full term LBW) than among women who were normal weight (11.8 % of preterm deliveries and 3.8% full term LBW) and overweight (10.3% of preterm deliveries and 3.1% full term LBW) prior to the pregnancy.



Note: Scale was set up from 0% to 20% to show the prevalence in more detail.

### Maternal Weight Gain<sup>3</sup>

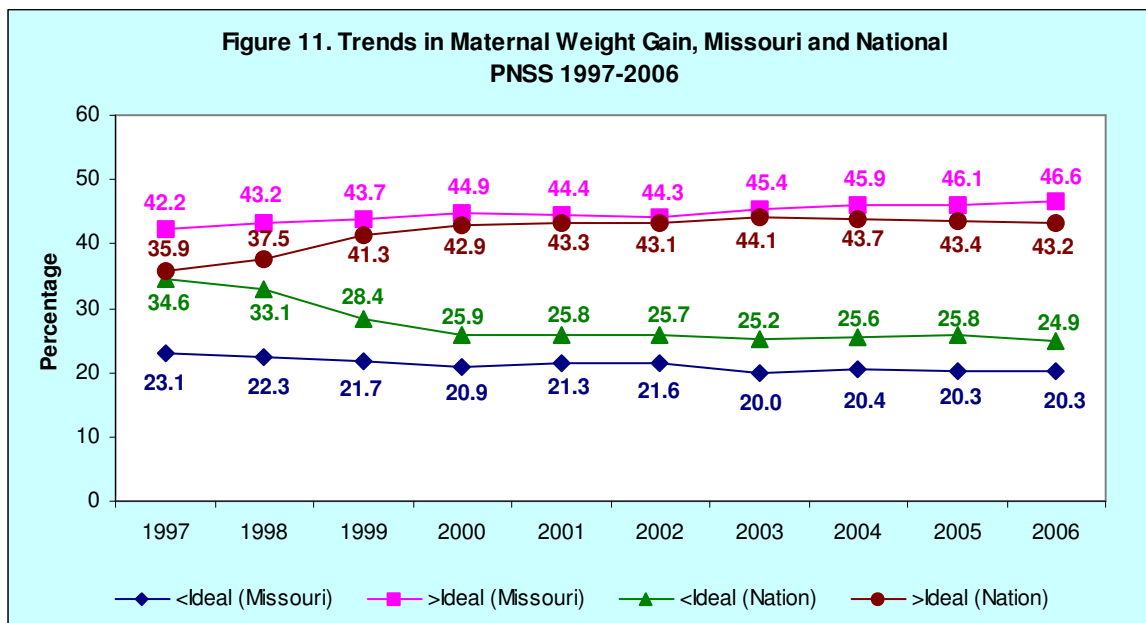
Maternal (gestational) weight gain refers to the amount of weight gained from conception to delivery. The Institute of Medicine (IOM) recommends higher weight gain for women with a low prepregnancy weight than for women with a high prepregnancy weight: 28-40 pounds (lbs) for underweight women, 25-35 lbs for normal weight women, 15-25 lbs for overweight women, and at least 15 lbs for obese women [5].

Gestational weight gain in full term pregnancies is the most significant predictor of birth weight and infant morbidity and mortality. Less than ideal gestational weight gain is associated with lower than average fetal growth; while greater than ideal gestational weight gain increases the risk of cesarean deliveries, spontaneous preterm delivery and is associated with neonatal complications [6]. Adequate gestational weight gain is affected by many factors, some of which are within the woman's control, such as the nutritional quality of foods she eats and whether or not she smokes during pregnancy. Other risk factors that affect adequate gestational weight gain are genetics, age, ethnic background, and income [7]. All of these factors can be taken into consideration and addressed by WIC agencies.

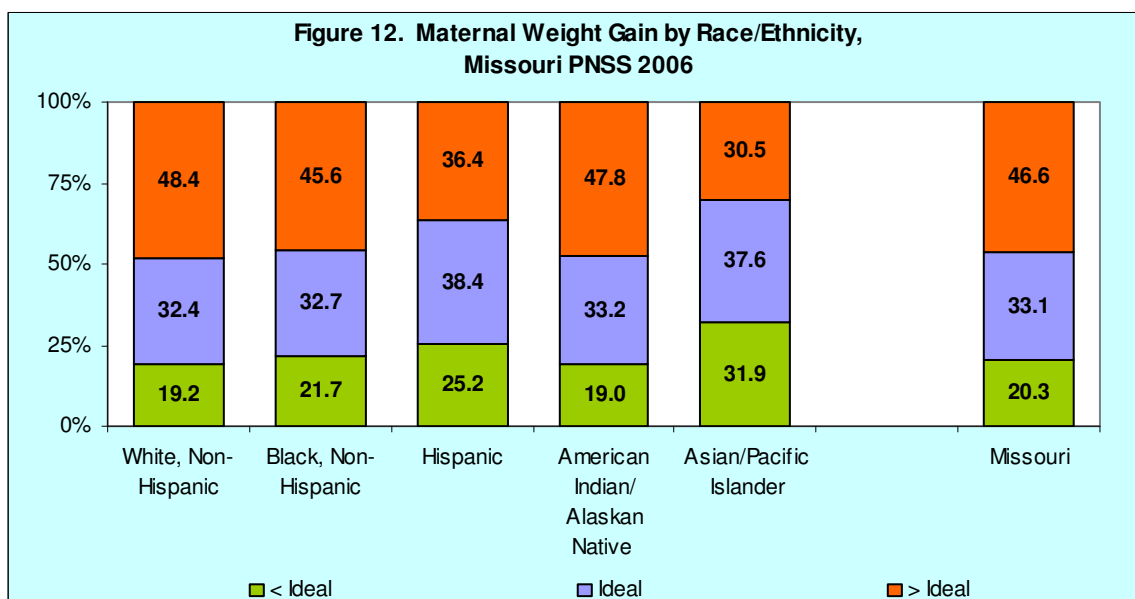
In the Missouri PNSS, the percentages of less than ideal and greater than ideal weight gain during pregnancy have been relatively stable from 1997 to 2006. The highest rate of greater than ideal gestational weight gain was reported in 2006 (46.6%). However, the percentage of

<sup>3</sup> Refer to the maps in [Appendix 3](#) to see prevalence of less than ideal maternal weight gain by county, and [Appendix 4](#) for prevalence of greater than ideal maternal weight gain by county (Missouri PNSS 2004-2006 combined years).

less than ideal gestational weight gain in 2006 (20.3%) has increased slightly from 2003 (20.0%), the lowest registered since 1997 (Figure 11).

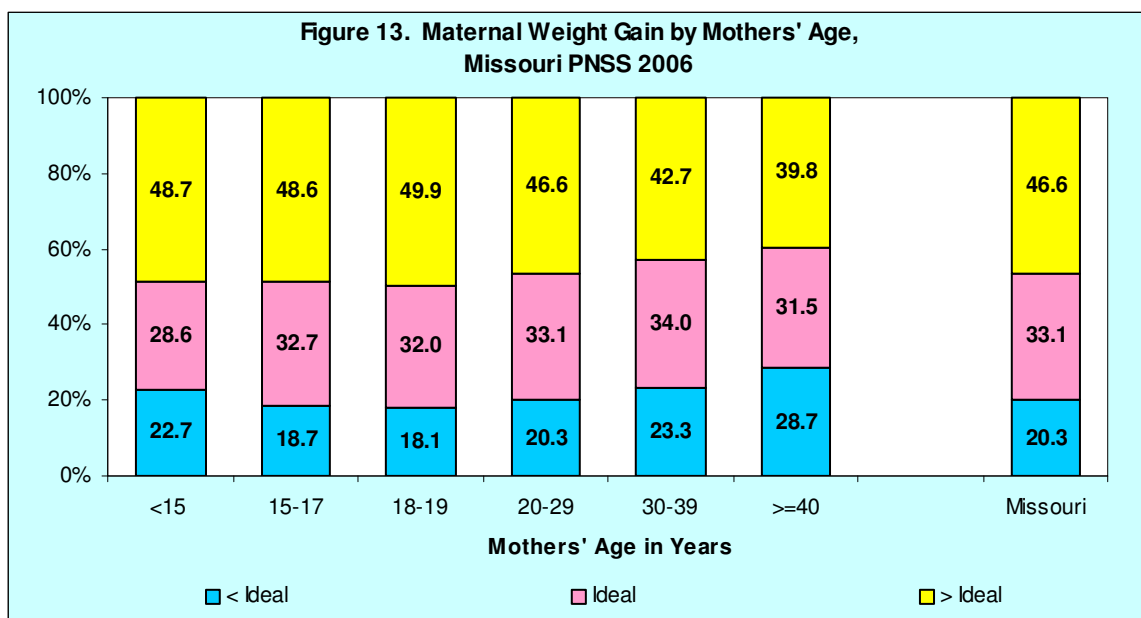


Note: Scale was set up from 0% to 60% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.



In the Missouri PNSS 2006, the majority of women (66.9%) did not gain adequate weight during pregnancy (20.3% gained less than ideal and 46.6% greater than ideal). Figure 12 shows that the prevalence of women with greater than ideal gestational weight gain was highest among Non-Hispanic White women (48.4%) and lowest among Asian/Pacific Islander women (30.5%). The prevalence of ideal weight gain during pregnancy among the Missouri 2006 PNSS population was lowest among Non-Hispanic White women (32.4%) and highest among Hispanic women (38.4%), compared to all other racial and ethnic groups.

In Figure 13, 18-19 year old women were more likely to gain greater than ideal weight during pregnancy (49.9%), while women who were 40 years or older were more likely to gain less than ideal weight (28.7%), compared to all other age groups. Women who were 30-39 years old showed the largest proportion of ideal maternal weight gain (34.0%).



In Figure 14, only 26.3% of women who were overweight before pregnancy gained ideal gestational weight, while a majority (64.1%) gained greater than ideal gestational weight. The highest percentage of women (42.2%) with ideal gestational weight gain was in the group of women who were underweight before pregnancy.

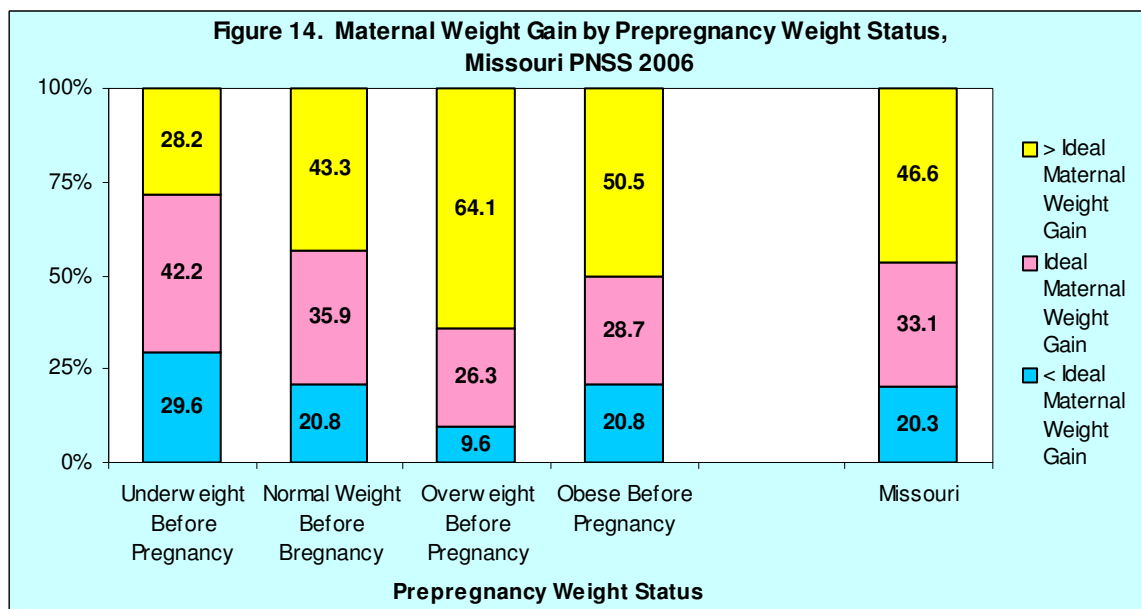
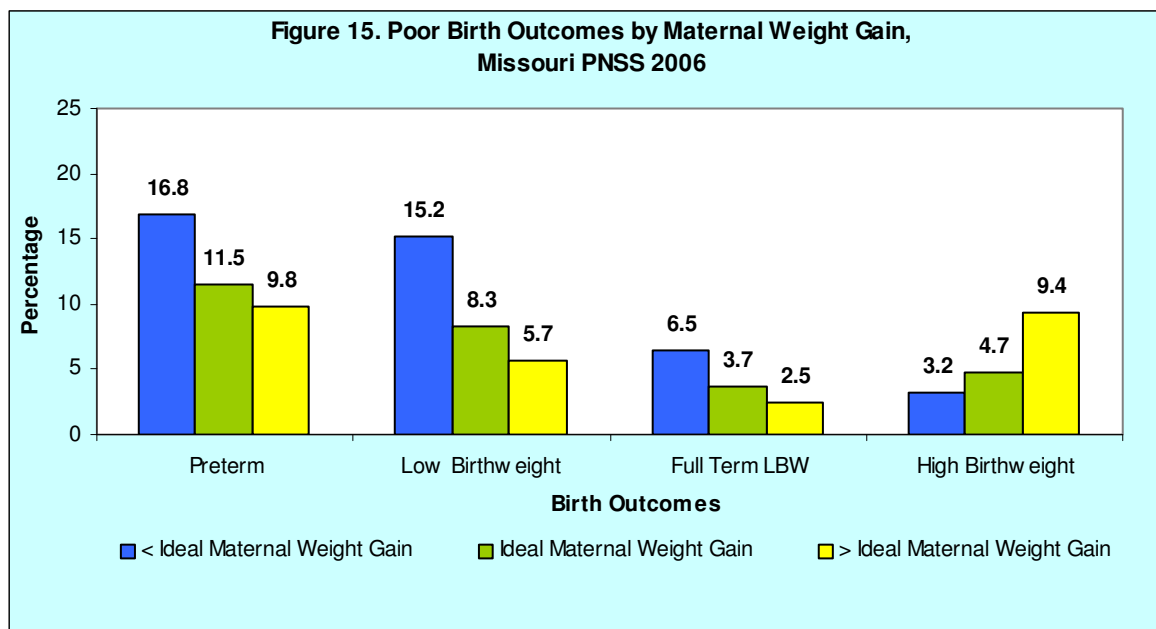


Figure 15 shows that women who gained less than ideal weight during pregnancy were more likely to deliver preterm (16.8%), low birthweight (15.2%), and full term low birthweight (6.5%) babies than women who gained ideal weight during pregnancy (11.5%, 8.3%, and 3.7%, respectively). On the other hand, women who gained greater than ideal weight were more likely to have an infant with high birthweight (9.4%) than women who gained the ideal (4.7%) or less than ideal (3.2%) weight during pregnancy.



Note: Scale was set up from 0% to 25% to show the prevalence in more detail.

#### Maternal Anemia (Low Hemoglobin/Hematocrit)<sup>4</sup>

Iron deficiency anemia during pregnancy is defined by CDC as less than the 5<sup>th</sup> percentile of the distribution of hemoglobin (Hb) or hematocrit (Hct) [8]. The distribution and cut-off values in the PNSS vary by trimester for pregnant women and are different from those for non-pregnant women.<sup>5</sup>

Causes of iron deficiency anemia in pregnant women are numerous and multifaceted. Iron-poor diet has been considered as the major cause of this disorder [9]. Cigarette smoking is another risk factor for having low hemoglobin/hematocrit, because it decreases absorption of micronutrients in the intestine [10]. Iron deficiency anemia can be treated with an excellent outcome [11]. Treatment may include an iron rich diet, iron supplements and multivitamin/mineral consumption [12].

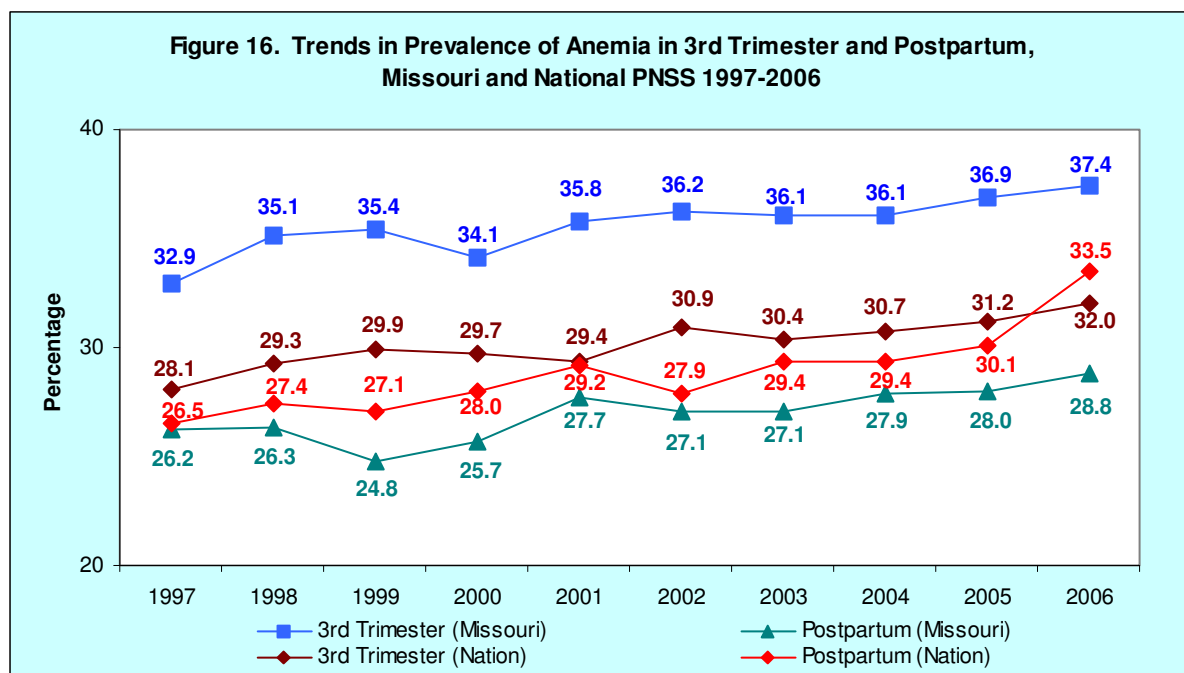
<sup>4</sup> Maps for the prevalence of anemia in 3<sup>rd</sup> trimester of pregnancy by county and the prevalence of anemia postpartum by county were not provided because over half of the counties had less than 100 cases for analysis on these two indicators.

<sup>5</sup> CDC has established criteria to determine if a woman has a low Hb/Hct during pregnancy. Cutoff values for non-smokers used to define low Hb/Hct during each trimester of pregnancy are: first and third trimesters -- Hb less than 11 gm divided by 1 deciliter (dl) or Hct less than 33%; second trimester -- Hb less than 10.5 gm divided by 1 deciliter (dl) or Hct less than 32%; postpartum -- Hb less than 12 gm divided by 1 deciliter (dl) or Hct less than 36%.

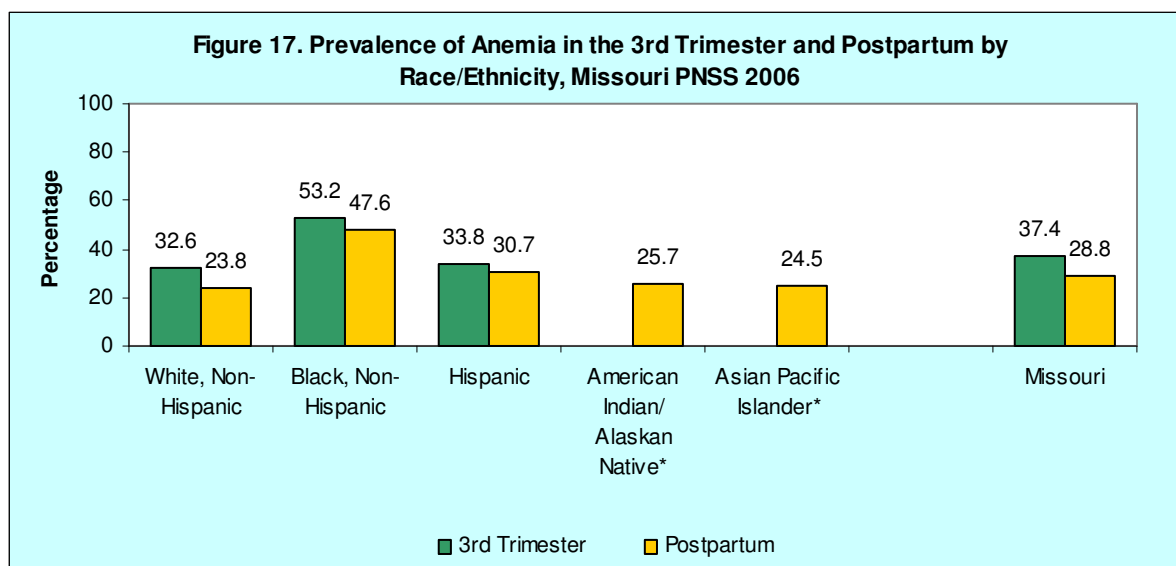


Iron deficiency anemia during the first two trimesters of pregnancy has been associated with inadequate gestational weight gain, a double risk for preterm delivery, and a 3 times higher risk for delivering a low birthweight infant [13]. Longitudinal studies have shown that the highest prevalence of iron deficiency anemia during pregnancy is in the third trimester [14]; therefore, the Healthy People 2010 Objective monitors the prevalence of iron deficiency anemia during the third trimester of pregnancy. This objective seeks to reduce the percentage of low-income women with iron deficiency anemia in the third trimester to 20% by 2010 [15].

In Figure 16, the trends of the prevalence of iron deficiency anemia among women participating in the Missouri PNSS for both the 3<sup>rd</sup> trimester and postpartum fluctuated somewhat from 1997 to 2000, but remained relatively stable since 2001.

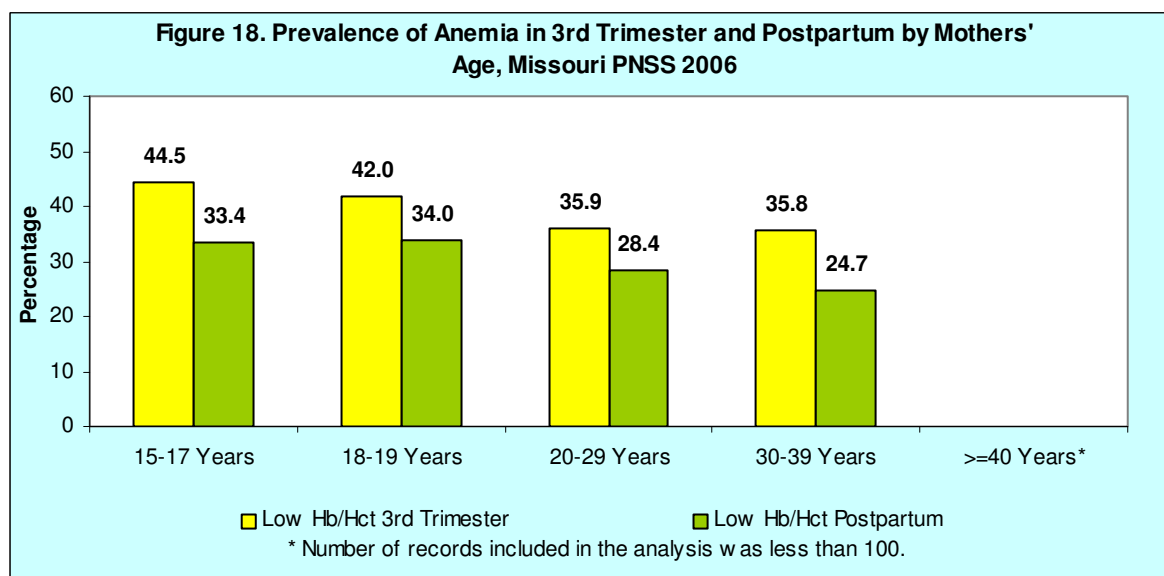


Note: Scale was set up from 20% to 40% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.



Note: \* The number of records for American Indian/Alaskan Native women in the 3<sup>rd</sup> trimester and the number of records for Asian Pacific Islander women in the 3<sup>rd</sup> trimester were too small (<100) for analysis.

The prevalence of iron deficiency anemia in the 3<sup>rd</sup> trimester in the Missouri 2006 PNSS varied among racial and ethnic groups (Figure 17). Non-Hispanic Black women were at a higher risk, compared to all other racial and ethnic groups. More than half (53.2%) of Non-Hispanic Black participants were diagnosed with iron deficiency anemia during the 3<sup>rd</sup> trimester, which was 1.6 times greater than the prevalence for Non-Hispanic White women (32.6%). Non-Hispanic Black women were at a higher risk of having iron deficiency anemia (47.6%) after delivery, which was 2.0 times greater than Non-Hispanic White Missouri PNSS participants (23.8%).



Note: Scale was set up from 0% to 60% to show the prevalence in more detail.

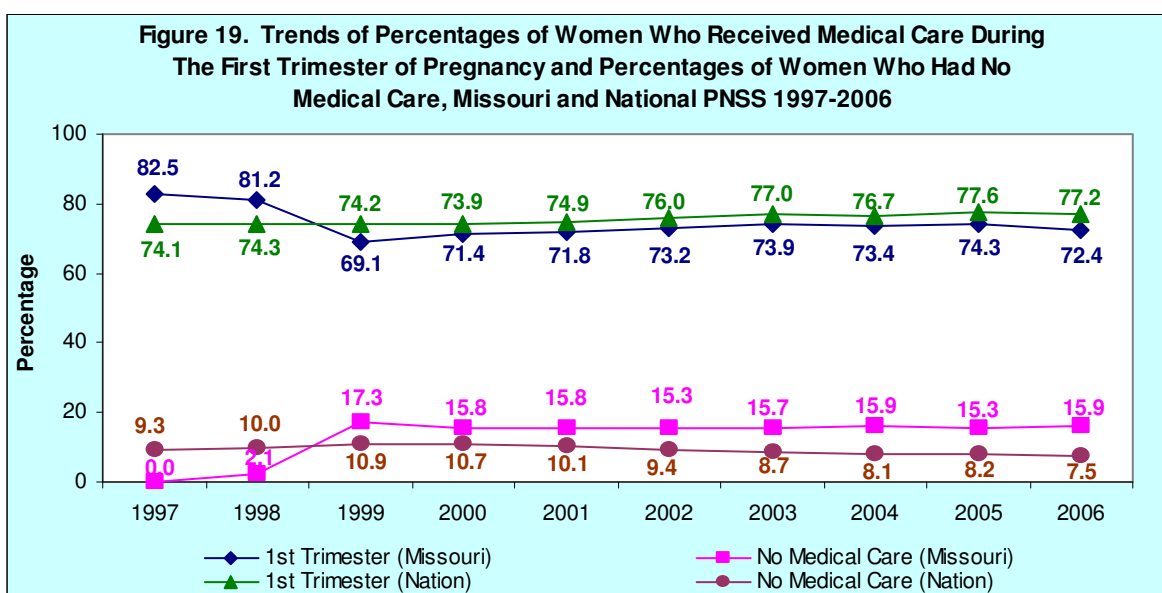
Another indicator associated with the percentage of iron deficiency anemia among PNSS participants is age. In Figure 18, the highest prevalence of iron deficiency anemia in 2006 Missouri PNSS participants in the 3<sup>rd</sup> trimester was in women age 15-17 years (44.5%). The highest prevalence (34.0%) of iron deficiency anemia after delivery was in women 18-19 years old. During the third trimester of pregnancy, the prevalence of iron deficiency anemia slightly

decreased with increasing age. A similar trend occurred in women in the postpartum period except that the prevalence for the 18-19 years old group was slightly higher than that of the 15-17 years old group.

### Medical Care<sup>6</sup>

Women who begin medical care after the first trimester are at a higher risk for poor pregnancy outcomes with infants being born premature, low birthweight or growth retarded [16]. One of the Healthy People 2010 Objectives is to increase the percentage of women who begin receiving medical care in the first trimester of pregnancy to 90% [15].

Medical care in the PNSS indicates the month in which medical care began for the current pregnancy. Medical care data were collected at the prenatal and postpartum visits. However, a WIC participant would have only postpartum medical care data if she was enrolled in the WIC program after delivering the baby. In Figure 19, almost three fourths of Missouri WIC participants in 2006 received medical care during the first trimester of pregnancy, and the proportion of women not receiving medical care during the first trimester remained quite stable during the time frame between 2000 (15.8%) and 2006 (15.9%).



Note: It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.

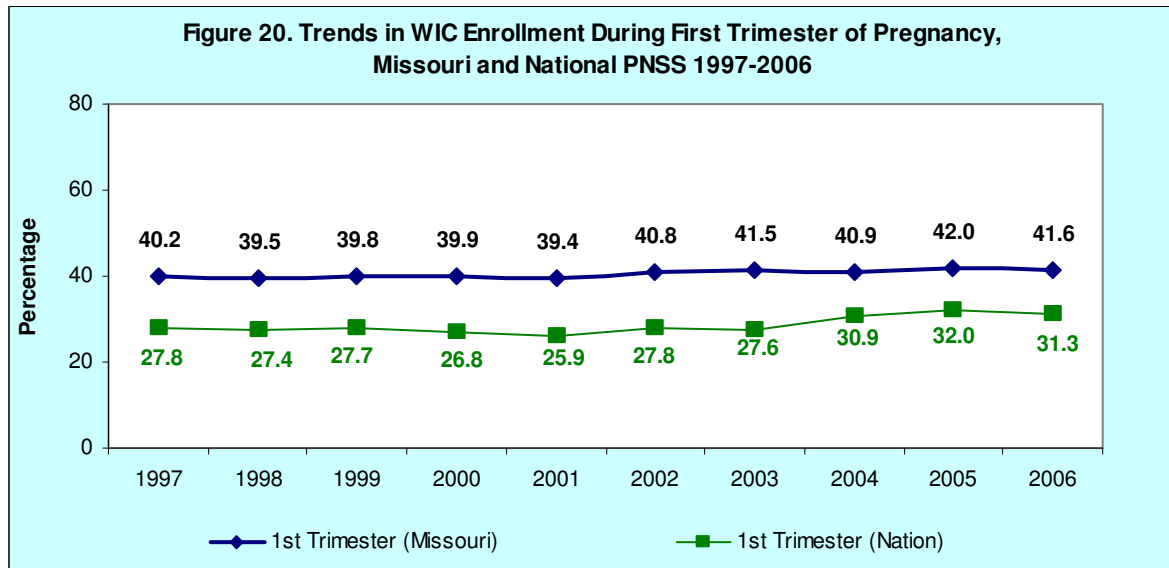
### WIC Enrollment<sup>7</sup>

A number of studies have shown that enrollment in WIC is associated with a lower prevalence of small-for-gestational-age deliveries and reduction of preterm delivery. In addition, longer enrollment in the WIC program is associated with a reduced risk of low birthweight. Women

<sup>6</sup> Refer to the maps in [Appendix 5](#) to see the percentage of WIC women who had medical care in the first trimester of pregnancy and [Appendix 6](#) for the percentage of WIC women who had no medical care during pregnancy (Missouri PNSS 2004-2006 combined years).

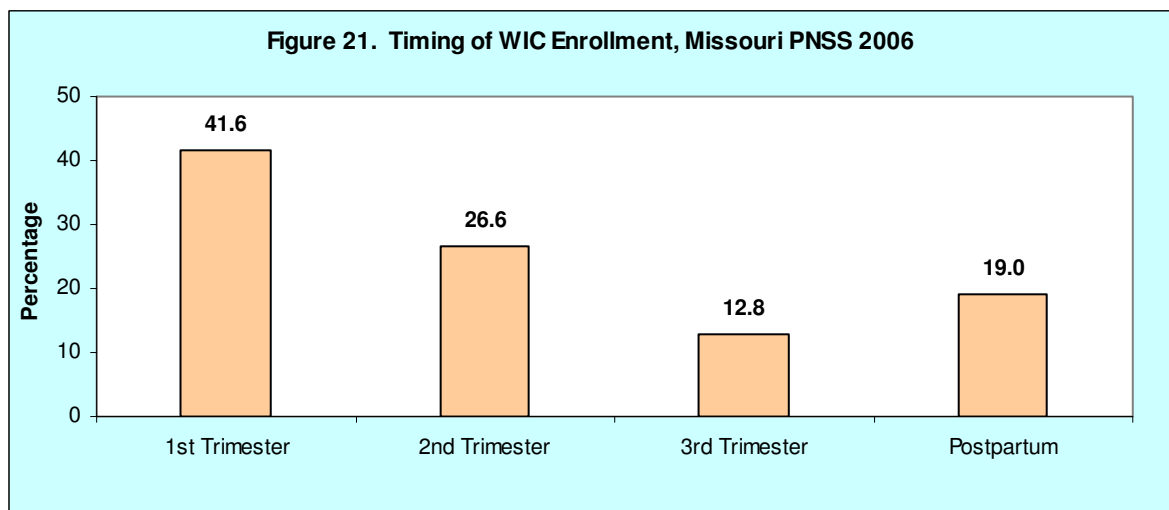
<sup>7</sup> Refer to the map in [Appendix 7](#) to see the percentage of women enrolled in WIC during the 1<sup>st</sup> trimester of pregnancy by county (Missouri PNSS 2004-2006 combined years).

who participate in WIC show better dietary intake and prenatal weight gain than those who do not [17]. The percentage of women in Missouri entering WIC during the first trimester of pregnancy increased slightly from 40.2% in 1997 to 41.6% in 2006 (Figure 20).



Note: Scale was set up from 0% to 80% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.

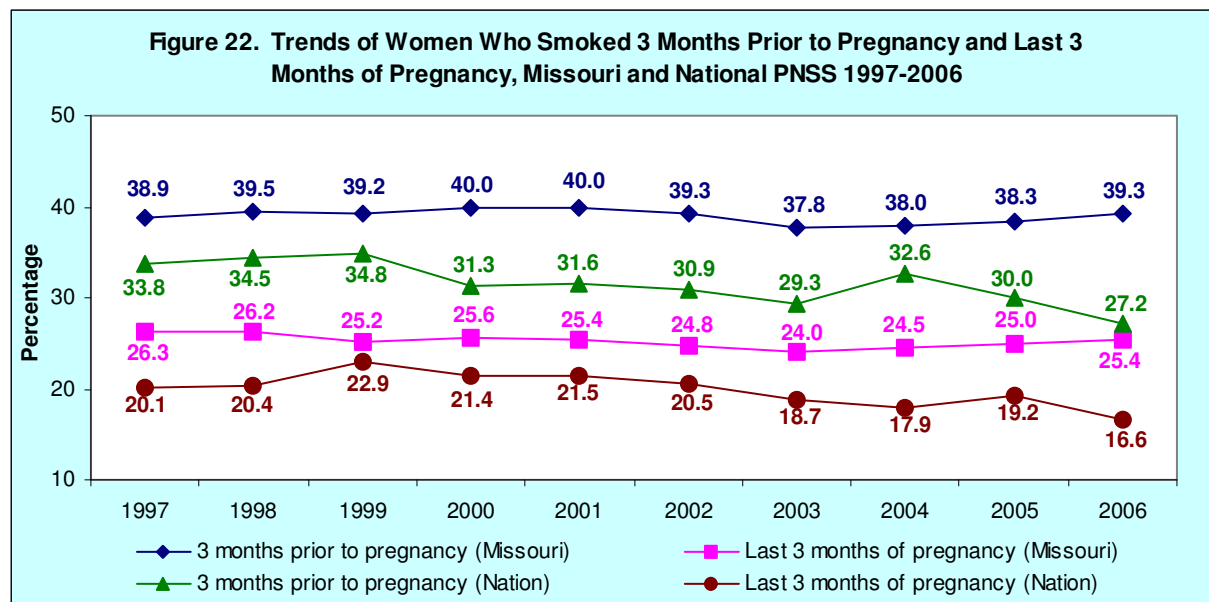
In the Missouri 2006 PNSS, the percentage of women enrolled in WIC during the first trimester of pregnancy was higher than in the 2<sup>nd</sup> and 3<sup>rd</sup> trimesters, and postpartum (Figure 21).



Note: Scale was set up from 0% to 50% to show the prevalence in more detail.

## Smoking During Pregnancy<sup>8</sup>

Smoking during pregnancy increases the risk of miscarriage, preterm birth, and infant death, including sudden infant death syndrome (SIDS or “crib death”) [18]. It is widely known that women who smoke during pregnancy are more likely to have low birthweight infants.



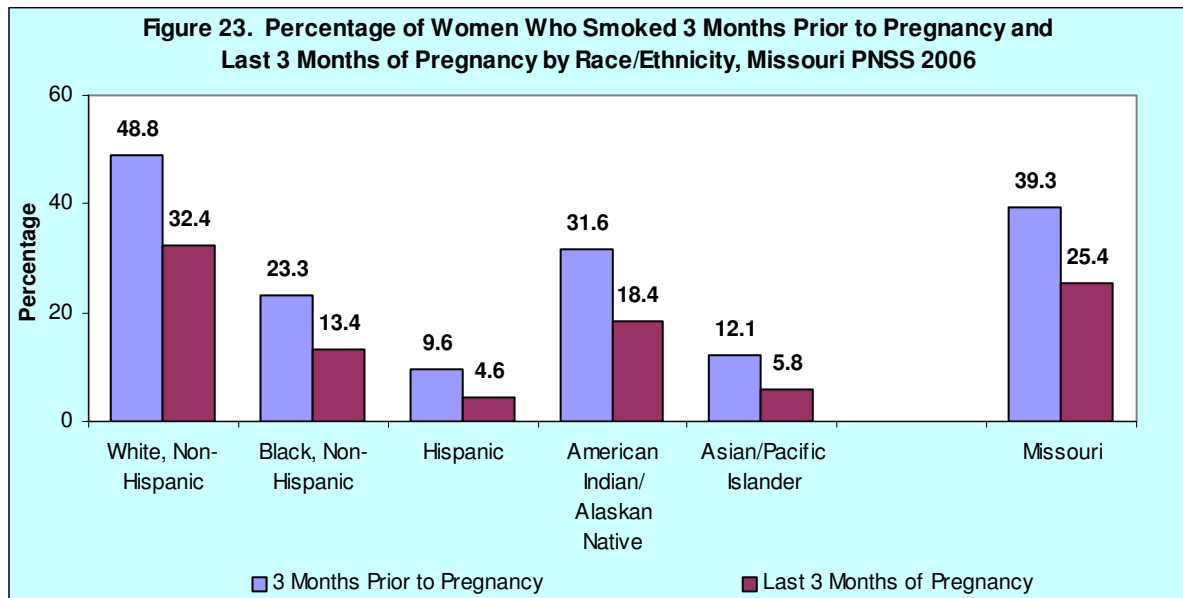
Note: Scale was set up from 10% to 50% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.

In the Missouri 2006 PNSS, the percentage of women who did not smoke during pregnancy and had low birthweight infants was 7.1%, but the percentage of women who smoked and had low birthweight infants was 10.2%. Figure 22 shows the 10-year trends (1997-2006) of the percentage of women in the WIC program who smoked 3 months prior to pregnancy and the last 3 months of pregnancy. For this time period, the lowest rate (37.8%) of smoking 3 months prior to pregnancy in Missouri PNSS was in 2003. Since that year, the rate for this indicator continued to increase to 39.3% in 2006.

The trend for WIC women who smoked the last 3 months of pregnancy decreased in general from 1997 (26.3%) to 2003 (24.0%), but increased since then to 25.4% in 2006. Figure 22 shows that each year, about one third of WIC women who smoked 3 months prior to pregnancy quit smoking after they were aware of their pregnancy. However, approximately one fourth of the WIC pregnant women indicated they smoked during the last three months of pregnancy for each year from 1997 to 2006. The 2010 Healthy People Objective is to reduce the rate of cigarette smoking during pregnancy to 1% [15].

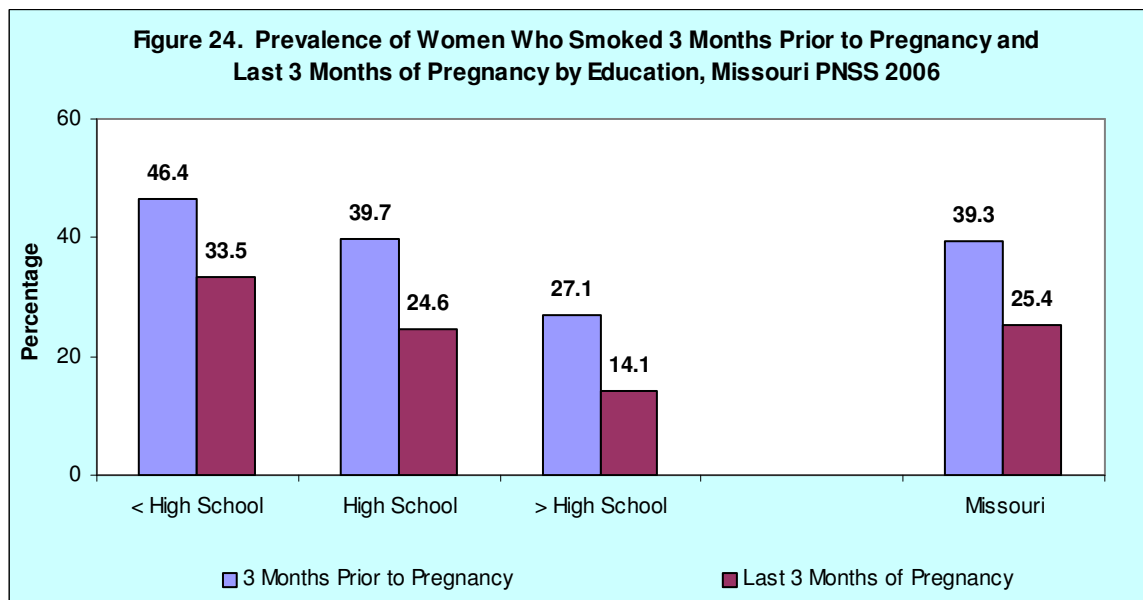
<sup>8</sup> Refer to the map in [Appendix 8](#) to see the percentage of women who smoked during the last 3 months of pregnancy by county (Missouri PNSS 2004-2006 combined years).

Figure 23 shows that Non-Hispanic White women in WIC had the highest rate of smoking 3 months prior to pregnancy (48.8%), while Hispanic women had the lowest rate (9.6%).



Note: Scale was set up from 0% to 60% to show the prevalence in more detail.

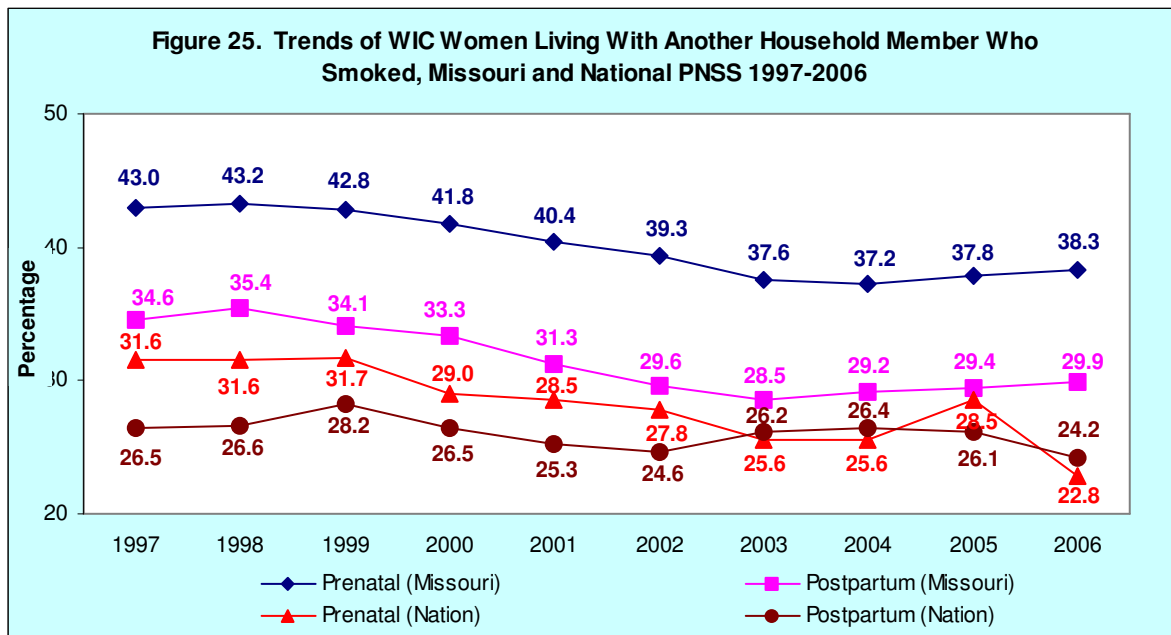
Educational level also had a strong impact on WIC women's smoking behaviors. The higher the level of education that a WIC woman had received, the less likely she would smoke prior to or during pregnancy. Figure 24 shows that the rates of WIC women who smoked 3 months prior to pregnancy and the last 3 months of pregnancy were highest among those who had less than a high school education (46.4% and 33.5%, respectively). In contrast, the rates for those who had greater than a high school education were lowest on these two indicators (27.1% and 14.1%, respectively).



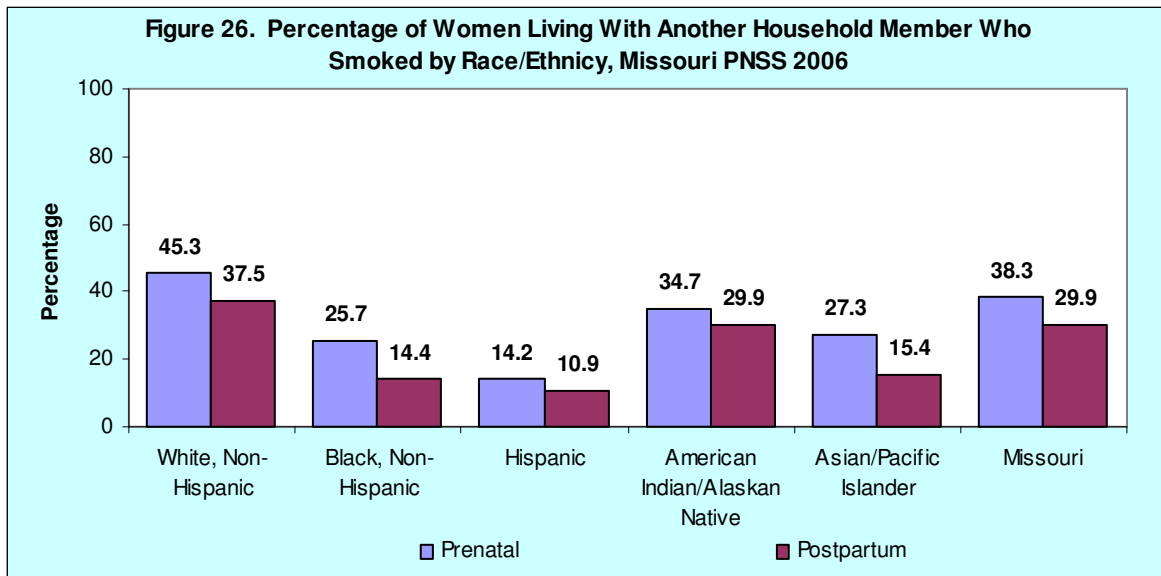
Note: Scale was set up from 0% to 60% to show the prevalence in more detail.

## Secondary Smoke from Other Household Members

Secondary smoke from other household members is also unhealthy for women during pregnancy, and for both the mother and the infant after birth. Infants exposed to secondary smoke are more likely to have respiratory infections [19]. In Figure 25, the 10-year trend data show that before 2002, more than 40% of Missouri WIC women in the prenatal period and more than 30% of WIC women in the postpartum period lived with other household members who were smokers. The prevalence of these two indicators decreased to 37.2% and 29.2% in 2004, but increased to 38.3% and 29.9% in 2006.



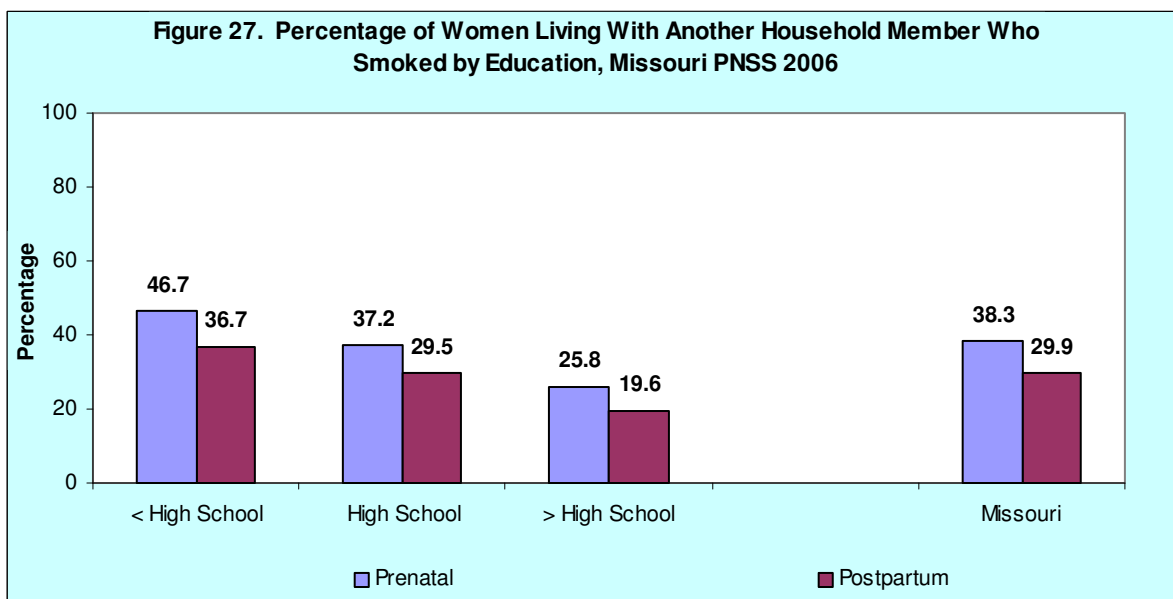
Note: Scale was set up from 20% to 50% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.



Similar to smoking during pregnancy, race/ethnicity had an impact on the rate of smoking from other household members. Figure 26 shows that during pregnancy, a higher percentage of Non-Hispanic White women (45.3%) and American Indian/Alaskan Native women (34.7%) than other racial and ethnic groups lived with another household member who smoked.

Comparatively, during pregnancy, a lower percentage of Hispanic women (14.2%) and Asian/Pacific Islander women (27.3%) lived in households with another member who smoked. The percentage of postpartum women living in households with another member who smoked was still highest for the Non-Hispanic White (37.5%) and lowest for the Hispanic women (10.9%).

WIC women's educational level also had an impact on the rate of secondary smoking in the household. Figure 27 shows that the higher the educational level of a WIC woman, the less likely this woman would be living with another household member who smokes.



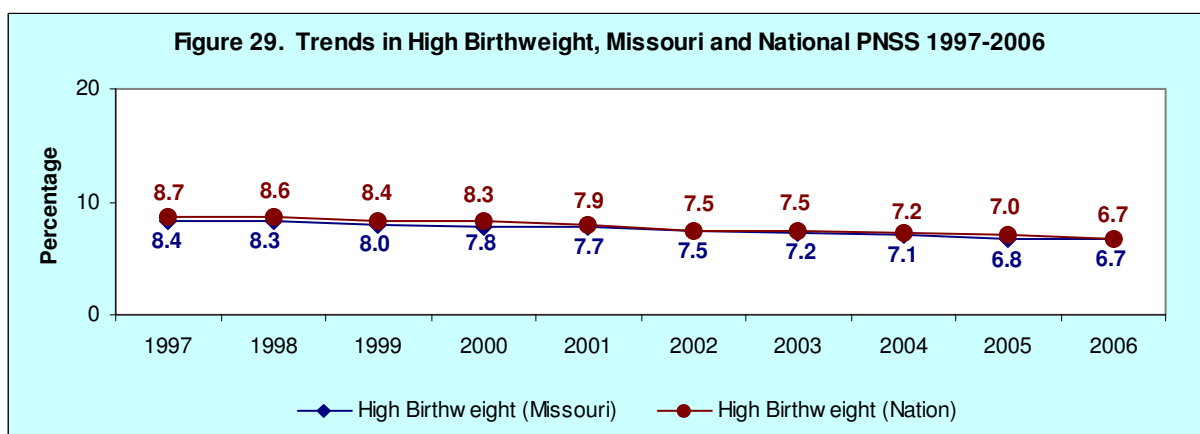
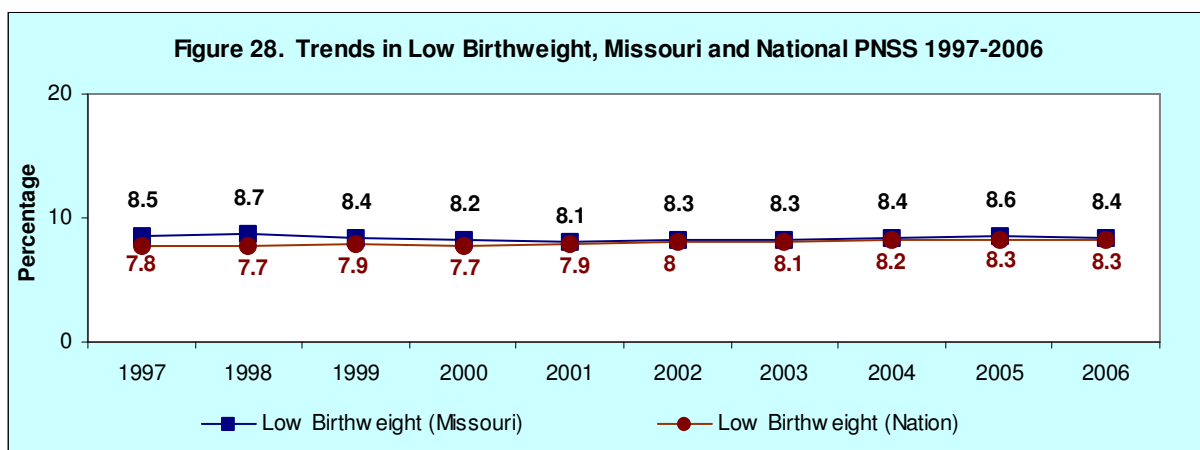


## INFANT HEALTH INDICATORS

### Low and High Birthweight<sup>9</sup>

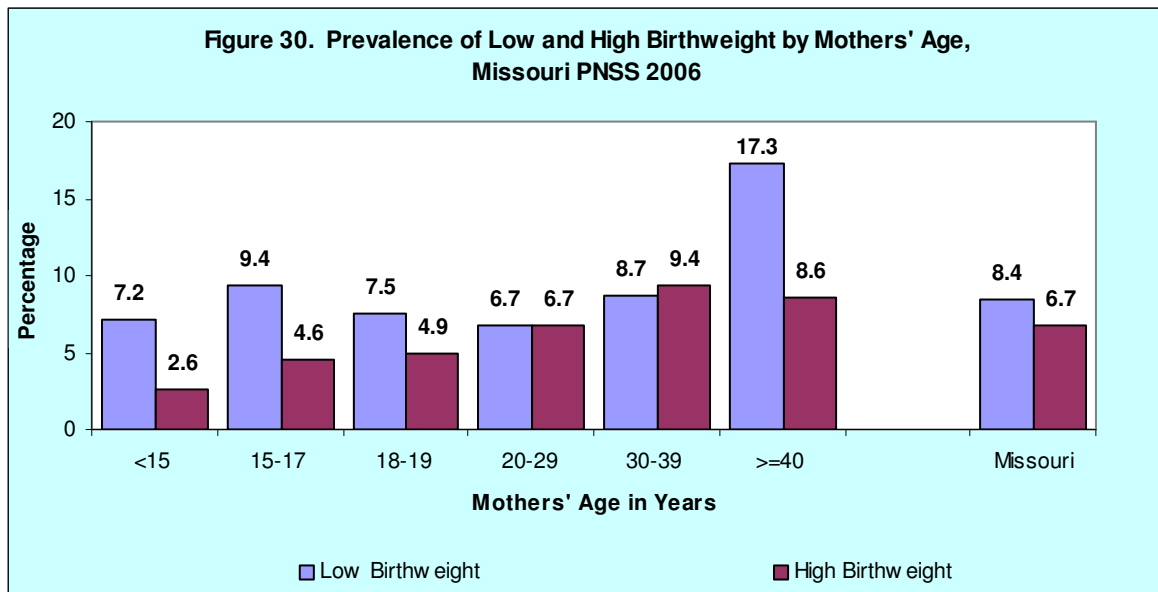
Low birthweight (less than 2,500 grams or 5.5 pounds) is a major determinant of neonatal mortality and post-neonatal mortality. Infants with low birthweight are more likely to experience developmental delays and disabilities than infants with normal birthweight [20][21]. The most important factors for low birthweight are cigarette smoking, followed by nutrition and pre-pregnancy weight [22]. In addition, teenage mothers are at a higher risk for low birthweight [23]. Socioeconomic factors are strongly associated with low birthweight [24]. The Healthy People 2010 Objective is to reduce the prevalence of low birthweight to less than 5% [15]. On the other hand, high birthweight (greater than 4,000 grams) significantly increases the risk of injuries such as shoulder dystocia [25].

In the 1996-2006 Missouri PNSS, the prevalence of low birthweight has remained fairly stable, while the proportion of infants with high birthweight has been decreasing slowly from 8.4% in 1997 to 6.7% in 2006 (Figures 28 and 29).



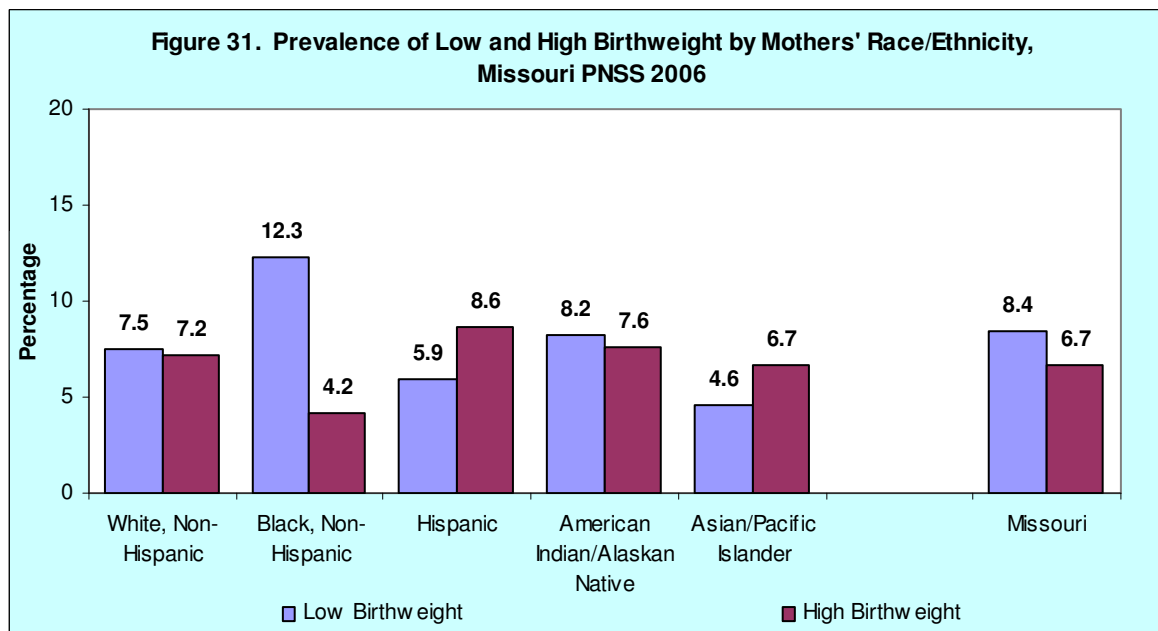
Note: Scale was set up from 0% to 20% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.

<sup>9</sup> Refer to the maps in [Appendix 9](#) to see prevalence of low birthweight by county, and [Appendix 10](#) for prevalence of high birthweight by county (Missouri PNSS 2004-2006 combined years).



Note: Scale was set up from 0% to 20% to show the prevalence in more detail.

Figure 30 shows that the risk of having a low birthweight infant was higher among women age 40 years and older (17.3%). In the Missouri 2006 PNSS, the highest risk of delivering a high birthweight infant (9.4%) was among women age 30-39 years.



Note: Scale was set up from 0% to 20% to show the prevalence in more detail.

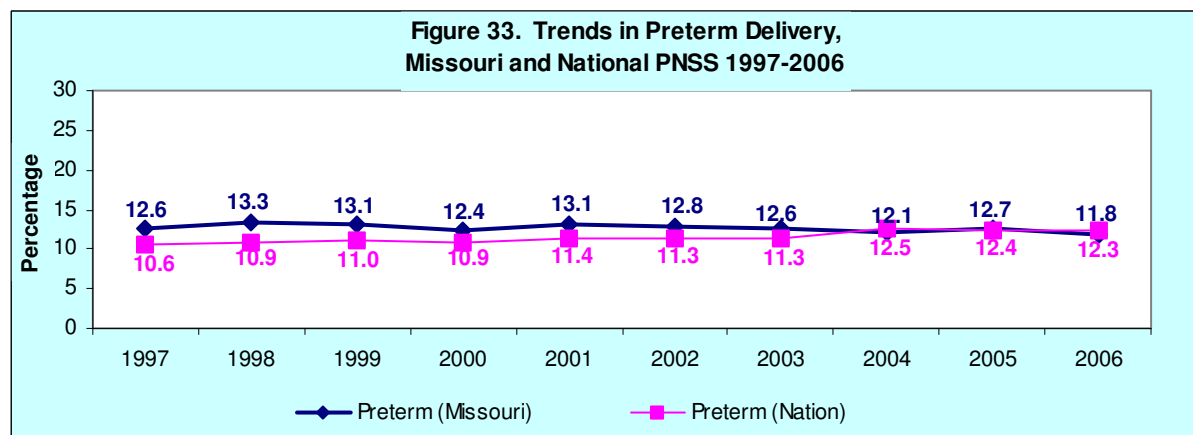
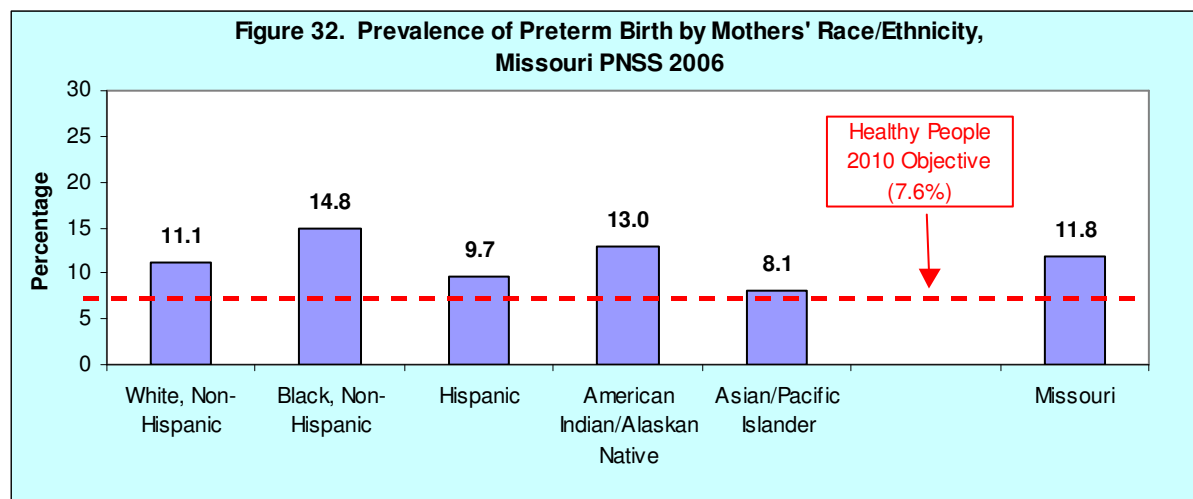
In the Missouri 2006 PNSS, Non-Hispanic Black women had the highest rate of delivering a low birthweight infant (12.3%) than all the other race or ethnicity groups (Figure 31). In fact, Non-Hispanic Black women were more than two times more likely to have low birthweight babies than Hispanic women and 1.6 times more likely than Non-Hispanic White women. In 2006, the proportion of infants born with low birthweight remained higher than the Healthy

People 2010 Objective of 5%. However, the prevalence of low birthweight in Asian Pacific Islander women (4.6%) had already reached the target.

### Preterm Delivery<sup>10</sup>

Preterm birth refers to delivery before 37 weeks of gestation. Preterm birth has been identified as one of the most important perinatal health problems in industrialized nations [26]. An infant born prematurely is at an increased risk of neurological and respiratory disorders, ocular diseases, and death [27]. It is increasingly recognized that the prevention of preterm birth is crucial to improving pregnancy outcomes [28]. The Healthy People 2010 Objective is to reduce preterm delivery to not more than 7.6% [15].

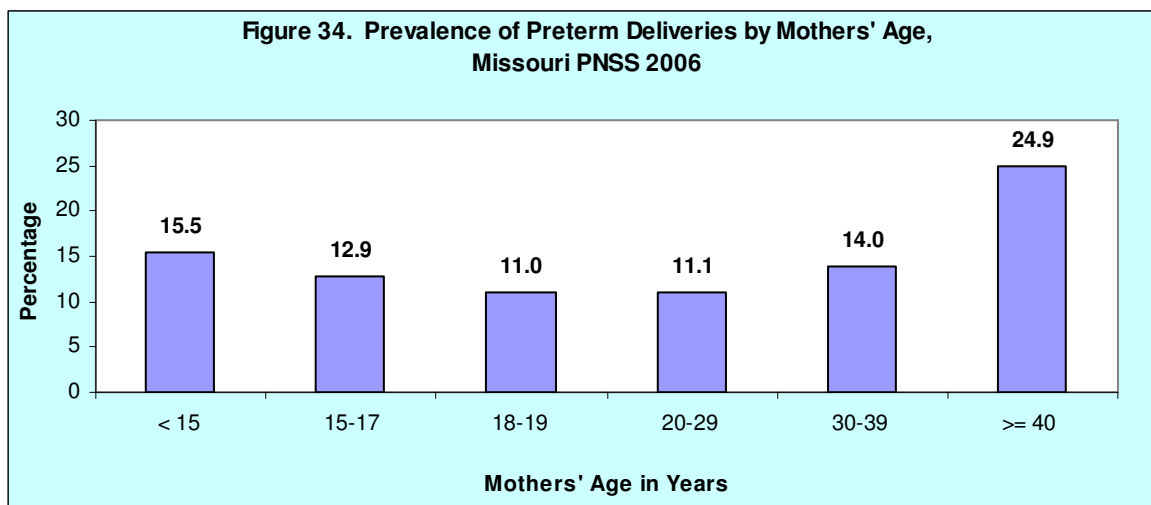
The prevalence of preterm delivery varied in race/ethnicity groups (Figure 32). In 2006, the highest rate (14.8 %) was for Non-Hispanic Black mothers, and the lowest rate (8.1%) was for Asian/Pacific Islander mothers. The trends remained fairly stable from 1997 to 2006 (Figure 33).



Note: Scales were set up from 0% to 30% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly, since they had different distributions on race/ethnicity.

<sup>10</sup> Refer to the map in [Appendix 11](#) to see prevalence of preterm delivery by county (Missouri PNSS 2004-2006 combined years).

In Figure 34, the highest proportions of preterm babies were born to mothers age 40 years and older (24.9%) and less than 15 years old (15.5%). However, since the numbers of women in these two age groups were small ( $n = 321$  for mothers 40 years and older and  $n = 155$  for mothers less than 15 years), caution needs to be taken in concluding that the percentages of preterm birth in these two age groups were much higher. The lowest percentage of preterm babies (11.0%) was among mothers in the 18-19 years age group.

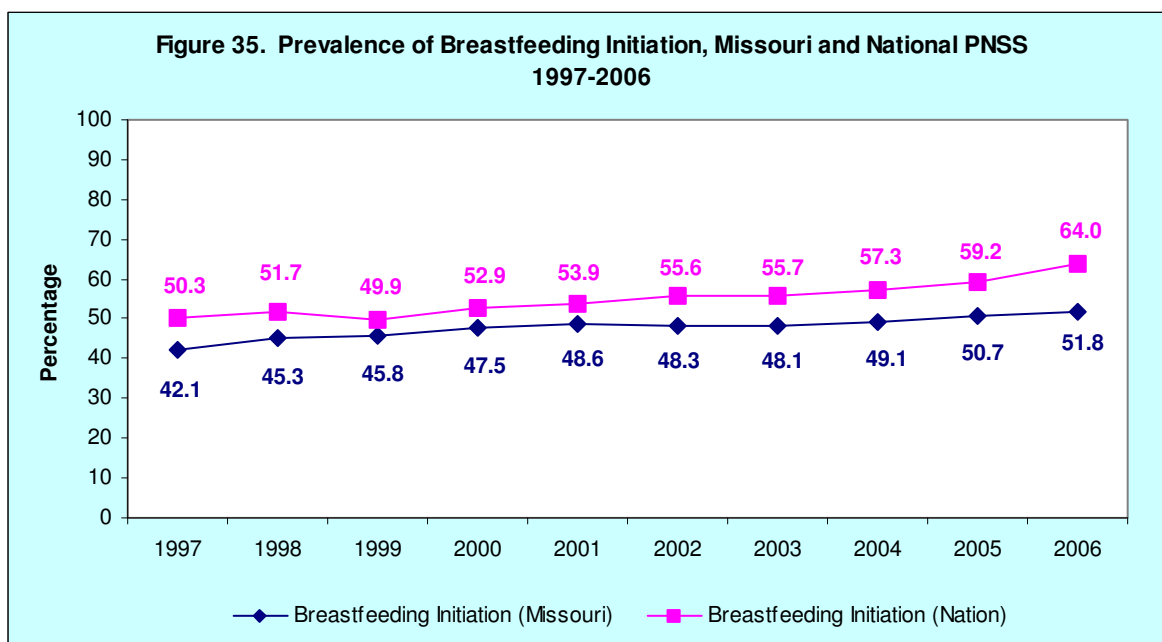


Note: Scale was set up from 0% to 25% to show the prevalence in more detail.

### Breastfeeding Initiation<sup>11</sup>

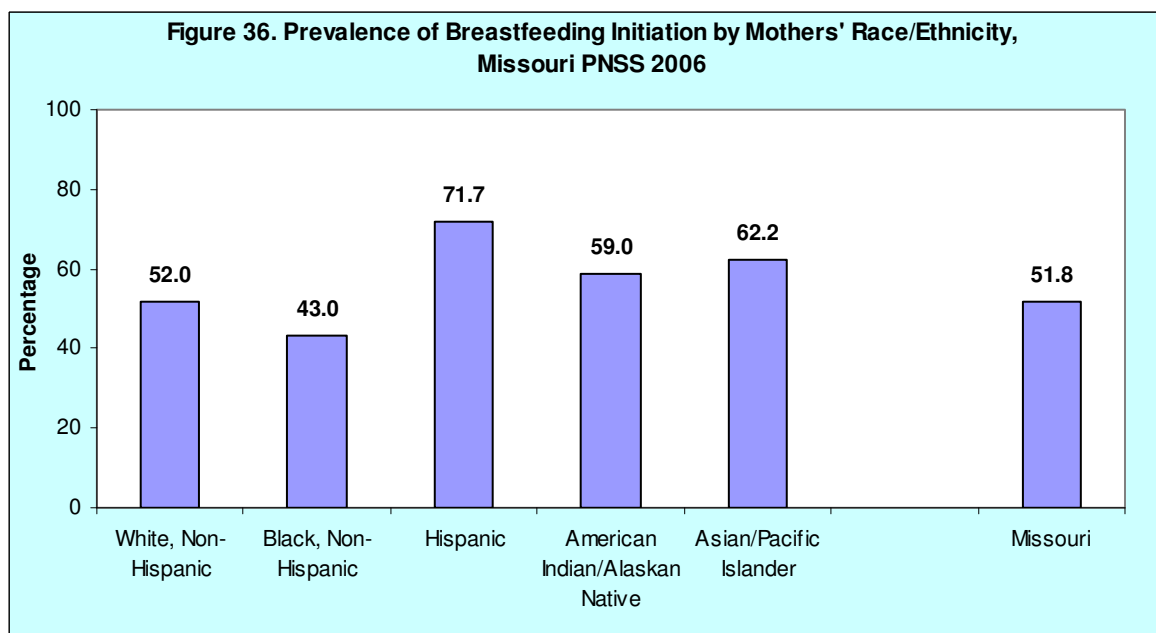
Advantages for infants, mothers, families, and society from breastfeeding have been documented by many studies [29] [30] [31] [32] [33] [34] [35]. These advantages include health, nutritional, immunologic, developmental, psychological, social, economic, and environmental benefits. The benefits for mothers include earlier return to prepregnancy weight and decreased risk of breast cancer. Breastfeeding is also associated with a lower incidence of obesity during childhood and adolescence, insulin-dependent diabetes mellitus, hypertension and hypercholesterolemia in adulthood. The Healthy People 2010 Objective for breastfeeding initiation is to increase the breastfeeding initiation rate to at least 75% [15].

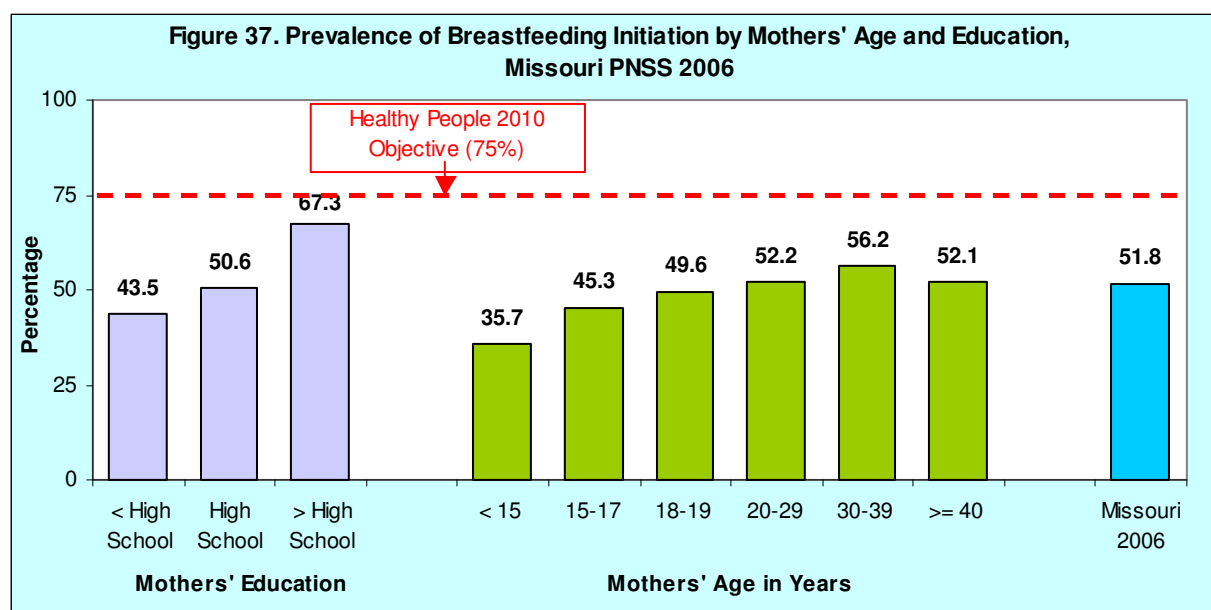
<sup>11</sup> Refer to the map in [Appendix 12](#) to see the breastfeeding initiation rate by county (Missouri PNSS 2004-2006 combined years).



Note: It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

From 1997 to 2006, the proportion of Missouri PNSS women who initiated breastfeeding increased from 42.1% to 51.8% (Figure 35). However, in the 2006 Missouri PNSS, the percentage of women who initiated breastfeeding was less than the Healthy People 2010 Objective of 75%. The percentage of breastfeeding initiation varied by mothers' race/ethnicity. Only 43.0% of Non-Hispanic Black mothers initiated breastfeeding, while 71.7% of Hispanic mothers initiated breastfeeding in the Missouri 2006 PNSS (Figure 36).





In Figure 37, the prevalence of breastfeeding initiation by mothers increased with age and educational level. In the Missouri 2006 PNSS, participants 30-39 years of age were 1.6 times more likely to report breastfeeding initiation, compared to women younger than 15 years. With regard to education, the highest percentage of mothers who initiated breastfeeding (67.3%) was among women with greater than high school education and the lowest percentage was among women with less than high school education (43.5%).

## CONCLUSIONS AND RECOMMENDATIONS

The Healthy People 2010 Objectives were designed to serve as goals for monitoring progress toward improving the health of the nation. Missouri's PNSS population is moving toward the goals on prenatal care, preterm birth, and breastfeeding initiation. There has been an overall slight increase in the percentage of pregnant women who received prenatal medical care in the first trimester since 1999 (but a slight decrease in 2006), and an overall slight decrease in the rate of preterm delivery since 1998. Also, there has been a significant increase in the percentage of mothers who initiated breastfeeding in the early postpartum period since 1997. However, Missouri is moving in the opposite direction toward the goals on greater than ideal weight gain during pregnancy, iron deficiency anemia, and smoking during pregnancy. The percentage of women who had greater than ideal weight gain has been increasing since 1997. There has been an overall slight increase in the prevalence of iron deficiency anemia among women in their 3<sup>rd</sup> trimester of pregnancy. The rate of smoking during the last three months of pregnancy also increased slightly since 2003. Finally, the prevalence of having low birth weight among infants remained relatively stable overall.

Compared with the National PNSS data<sup>12</sup> as shown in Table 1, the percentage of pregnant women in Missouri PNSS who had ideal weight gain was higher than the national average

<sup>12</sup> The proportions of racial and ethnic indicators in the national 2006 PNSS were different from those in the Missouri 2006 PNSS. Therefore, to make the Missouri PNSS population comparable on indicators of interest to the Nation, a standardization procedure was applied to Missouri's PNSS data when a comparison occurred. The procedure is available on CDC's website: [http://www.cdc.gov/pednss/how\\_to/interpret\\_data/what/example.htm](http://www.cdc.gov/pednss/how_to/interpret_data/what/example.htm).

level. The percentage of women who had preterm births, and the percentage of women who had low birthweight babies were lower than the national average levels. However, the percentage of pregnant women who had iron deficiency anemia in the third trimester and the percentage of women who smoked during the last three months of pregnancy were higher than the national average levels. The percentage of women who received medical care in the first trimester and the percentage of women who initiated breastfeeding were lower than the national average levels.

**Table 1. Monitoring Healthy People 2010 Objectives Using Missouri PNSS Trends 1997-2006 and Comparing Missouri and National PNSS Data in 2006 on Selected Health and Behavioral Indicators**

Indicator	Healthy People 2010 Objectives Monitored by PNSS*	Trend of the Missouri PNSS Data 1997-2006	National PNSS Data 2006	Missouri PNSS Data 2006**
Ideal Weight Gain	Increase the proportion of women who achieve a recommended weight gain during their pregnancies (no target established)	Decrease	31.9%	34.4%
Anemia in 3 <sup>rd</sup> Trimester	Decrease the proportion of low-income pregnant women with iron deficiency anemia in the third trimester to <b>20%</b> (19-13)	Relatively stable, but overall slight increase since 1997	32.0%	35.8%
Medical Care 1 <sup>st</sup> Trimester	Increase the proportion of pregnant women who receive medical care in the first trimester to <b>90%</b> (16-10a)	Overall slight increase since 1999	77.2%	71.5%
Smoking During the Last 3 Months of Pregnancy	Reduce the rate of smoking during pregnancy to <b>1%</b> (16-17c)	Slight decrease from 1997 to 2003, but slight increase since then	16.6%	18.5%
Low Birthweight	Decrease low birthweight to <b>5%</b> (16-10b)	Relatively stable	8.3%	8.1%
Preterm Birth	Decrease preterm births to <b>7.6%</b> (16-11)	Overall slight decrease since 1998	12.3%	11.5%
Breastfeeding Initiation	Increase the proportion of mothers who breast feed in the early postpartum period to <b>75%</b> (16-19a)	Increase	64.0%	56.3%

\*Healthy People 2010 Objectives on web: <http://www.healthypeople.gov>.

\*\*Adjusted rates according to CDC's procedure.

The 2006 Missouri PNSS data indicate that state and community public health programs are needed to support the following interventions to meet the state health goals for maternal and child nutrition in low-income populations:

- Encourage women who are underweight before pregnancy to gain weight to reach normal prepregnancy weight to prevent complications, such as low birthweight and preterm delivery. In contrast, women who are overweight or obese before pregnancy could be counseled on how to manage weight to prevent the related negative birth outcomes, such as high birthweight.
- Support nutrition education focused on iron rich foods and iron absorption-enhancing foods to help reduce the percentage of women with low hemoglobin/hematocrit participating in PNSS. Also, promote adequate multivitamin and iron supplement intake during pregnancy to decrease the risk of having iron deficiency anemia.

- Increase efforts in promoting early identification of pregnancy and early entry into comprehensive prenatal care, including medical care and WIC program services to better help pregnant women obtain all the important information and counseling needed, such as the harm of smoking and the benefit of appropriate food intake.
- Apply the evidence-based approach called the “5 A’s” to help pregnant women quit smoking. The approach is recommended by the U.S. Public Health Service and the American College of Obstetricians and Gynecologists and has been proven effective for most pregnant smokers.<sup>13</sup>
- Continue establishment of breastfeeding as a social norm. Research indicates that programs combining breastfeeding education with behaviorally oriented counseling were associated with increased rates of breastfeeding initiation and its continuation for up to 3 months.

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<sup>13</sup> The evidence-based counseling method follows five steps (the “5 A’s”): 1. Ask your patient about her smoking status; 2. Advise her in a clear, strong and personalized manner about the risks of smoking and the benefits of quitting for her self and her fetus; 3. Assess her willingness to make a quit attempt within the next 30 days; 4. Assist her with ways to quit by: suggesting problem solving methods and skills for quitting, providing support as part of the treatment, helping her arrange support among family, friends, and co-workers and providing pregnancy-specific cessation materials; 5. Arrange follow-up contacts with her to assess her smoking status, encourage smoking cessation if she continues to smoke, and refer her to more intensive help if needed. More information is on the website: <http://www.helppregnantsmokersquit.org/>.

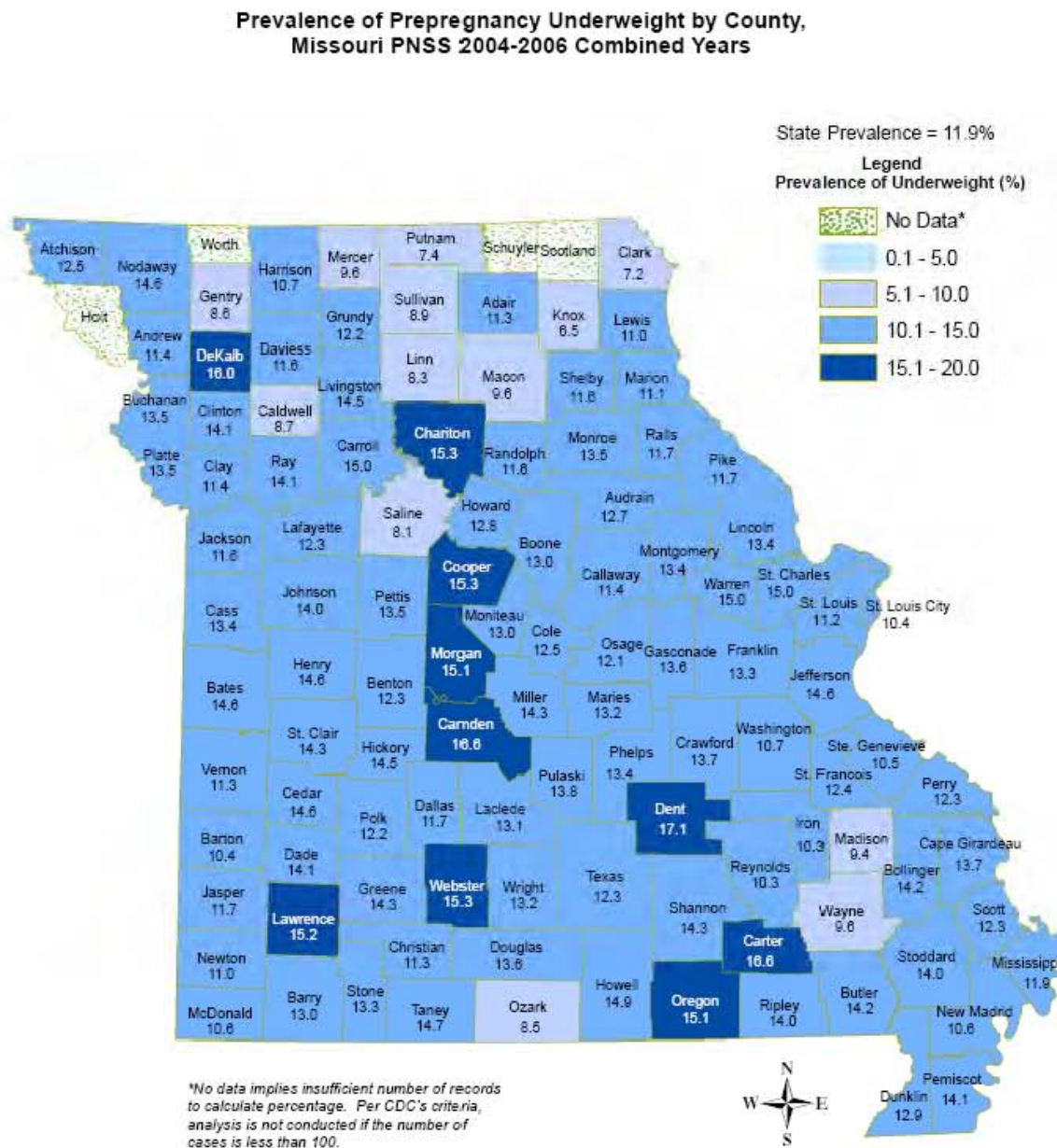


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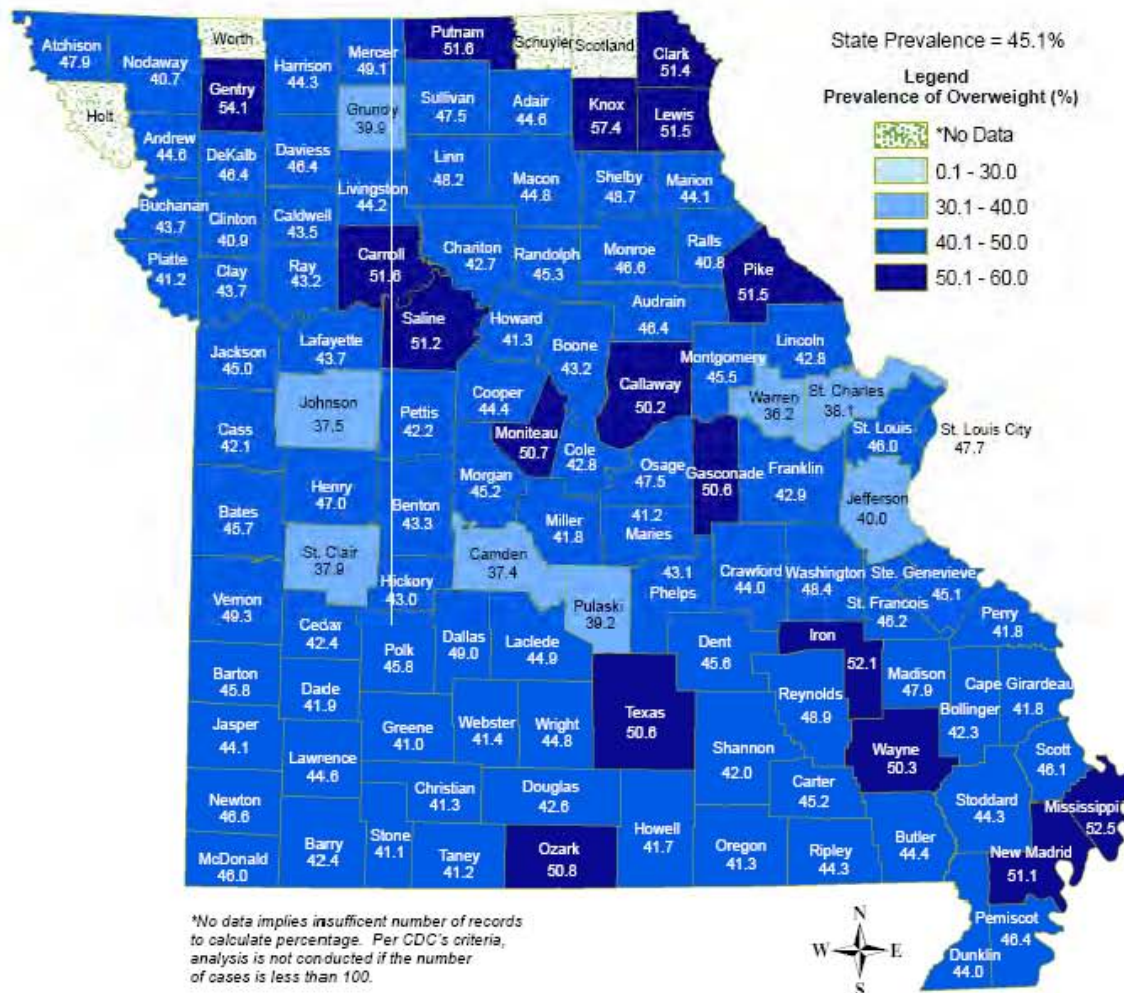
## APPENDICES

### Appendix 1



Appendix 2

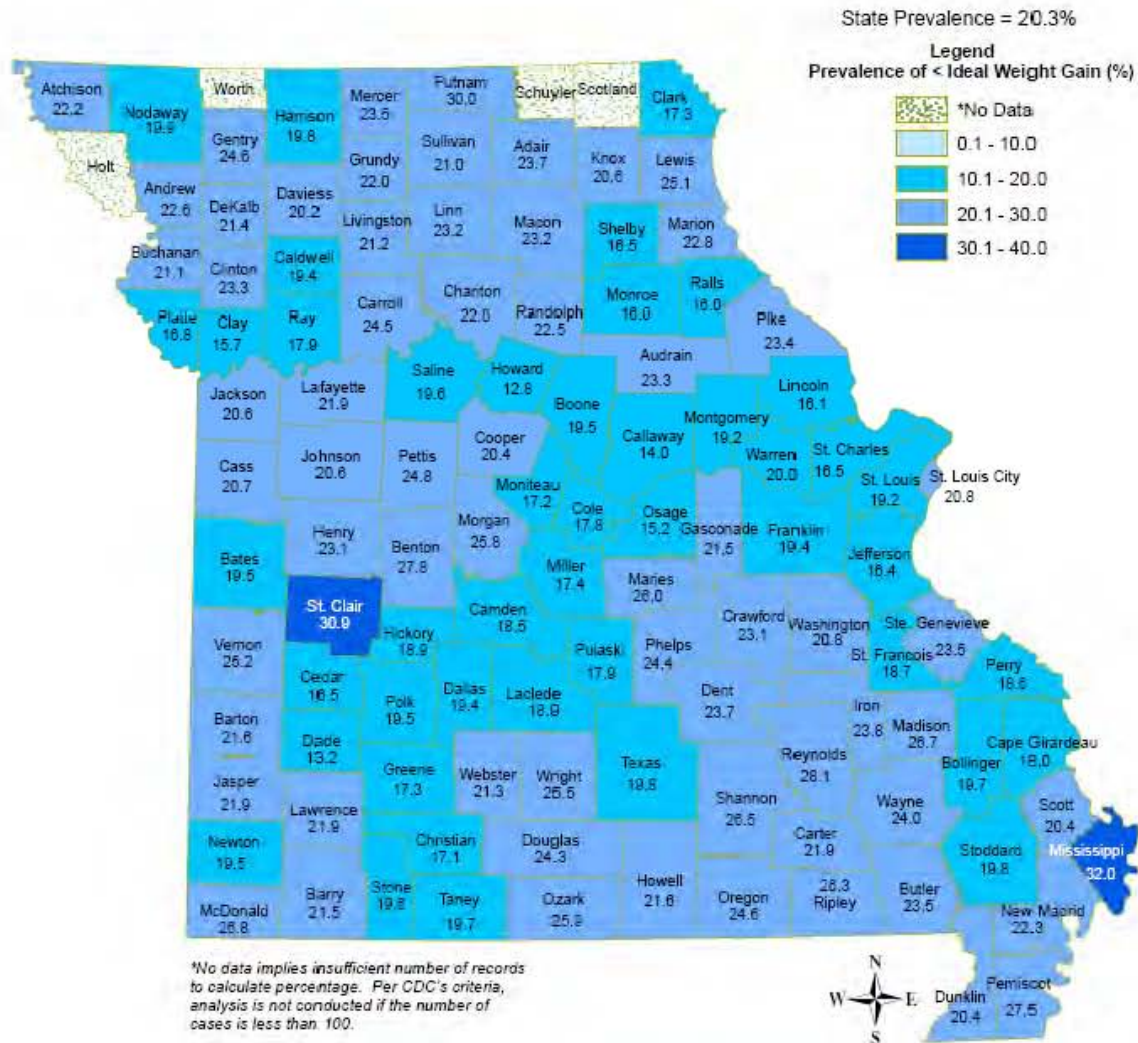
**Prevalence of Prepregnancy Overweight by County,  
Missouri PNSS 2004-2006 Combined Years**





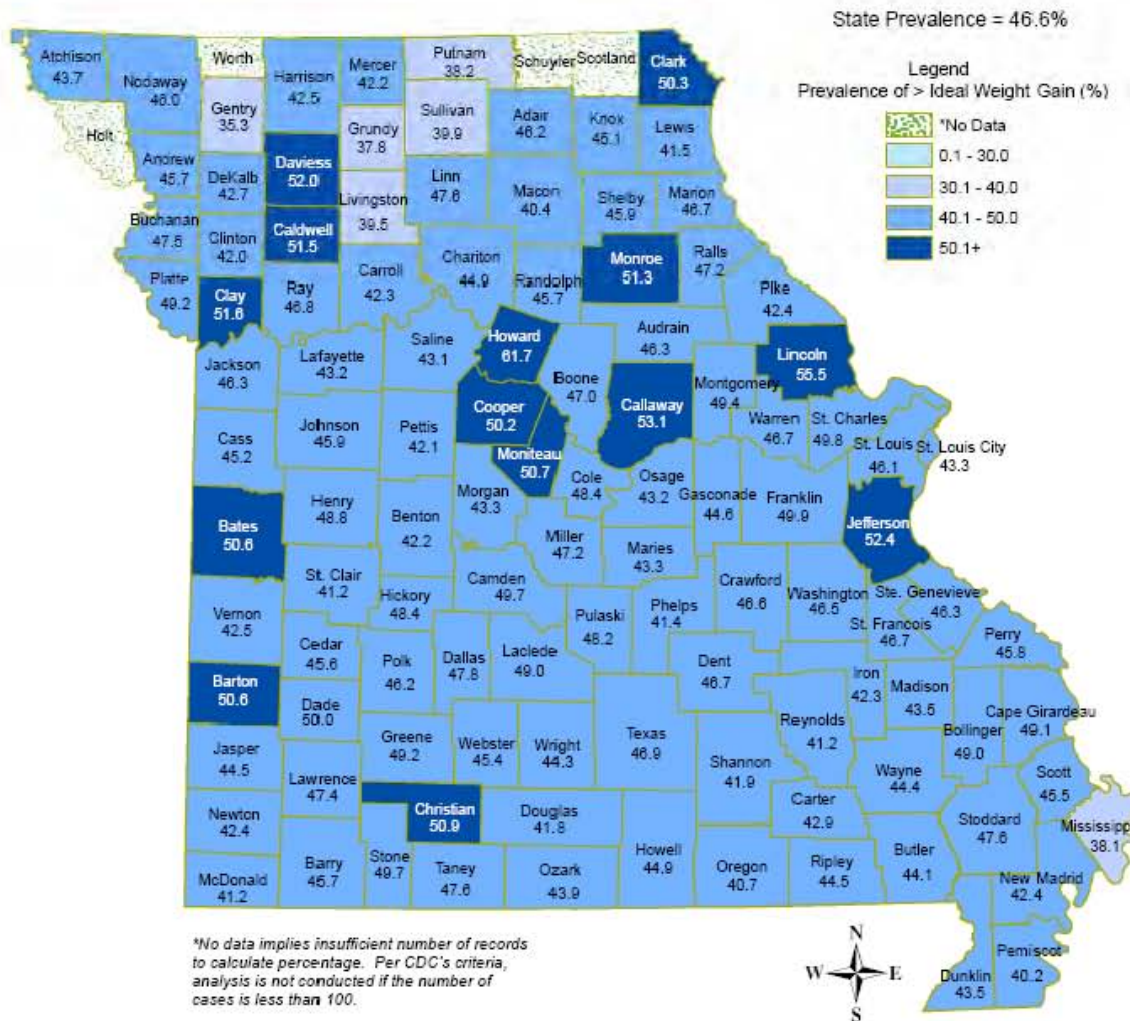
# Appendix 3

## Prevalence of Less than Ideal Maternal Weight Gain by County, Missouri PNSS 2004-2006 Combined Years



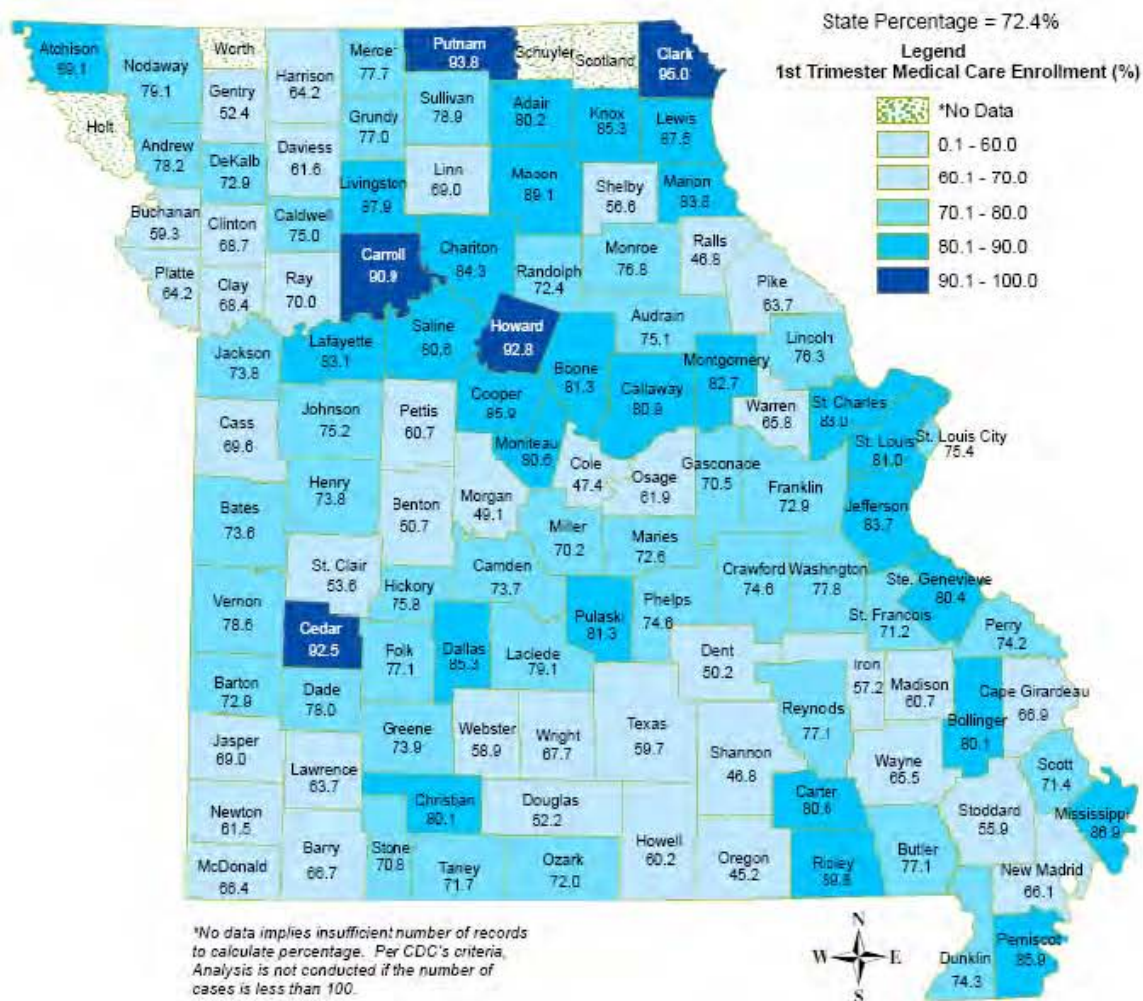
Appendix 4

**Prevalence of Greater than Ideal Maternal Weight Gain by County,  
Missouri PNSS 2004-2006 Combined Years**



## Appendix 5

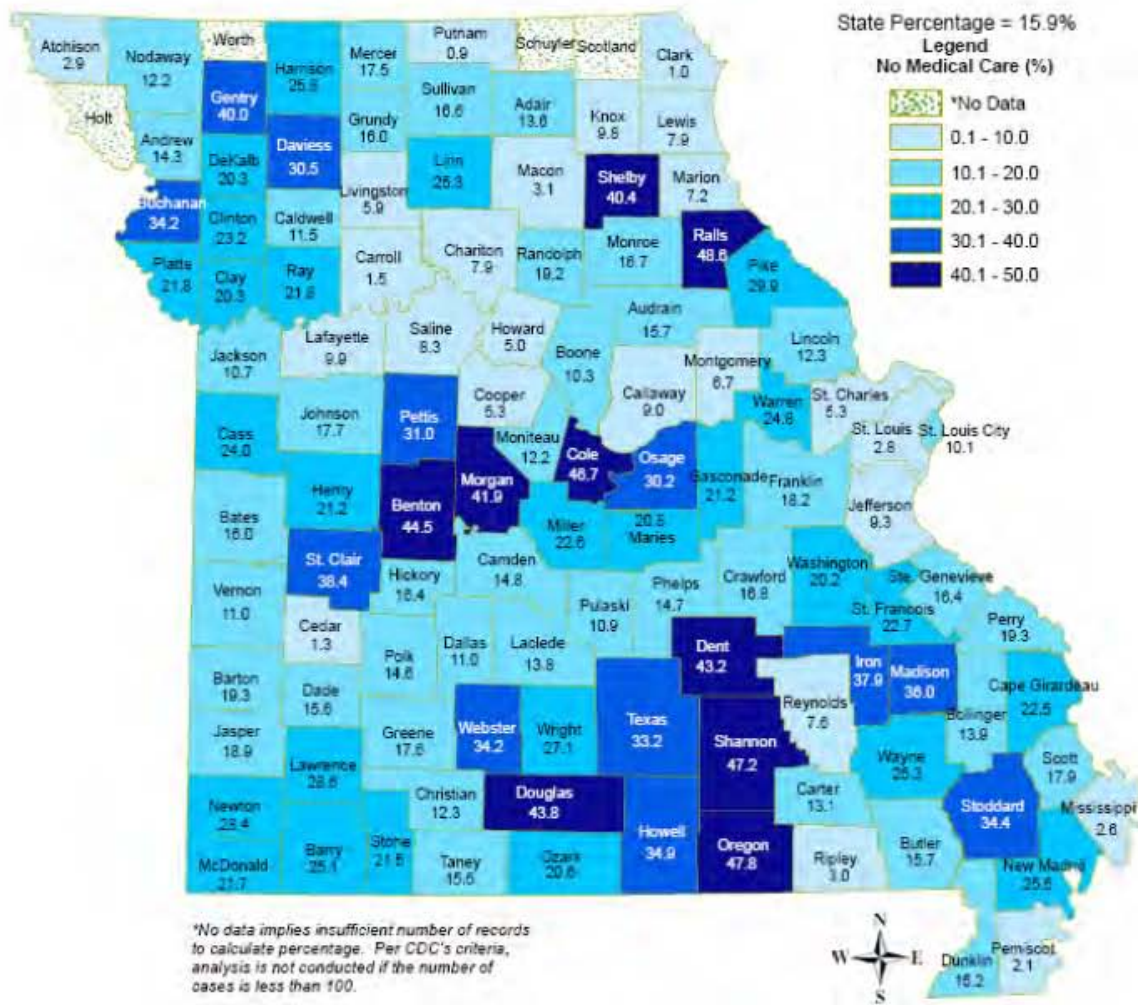
### Percentage of WIC Women Who Had Medical Care in the First Trimester of Pregnancy by County, Missouri PNSS 2004-2006 Combined Years





## Appendix 6

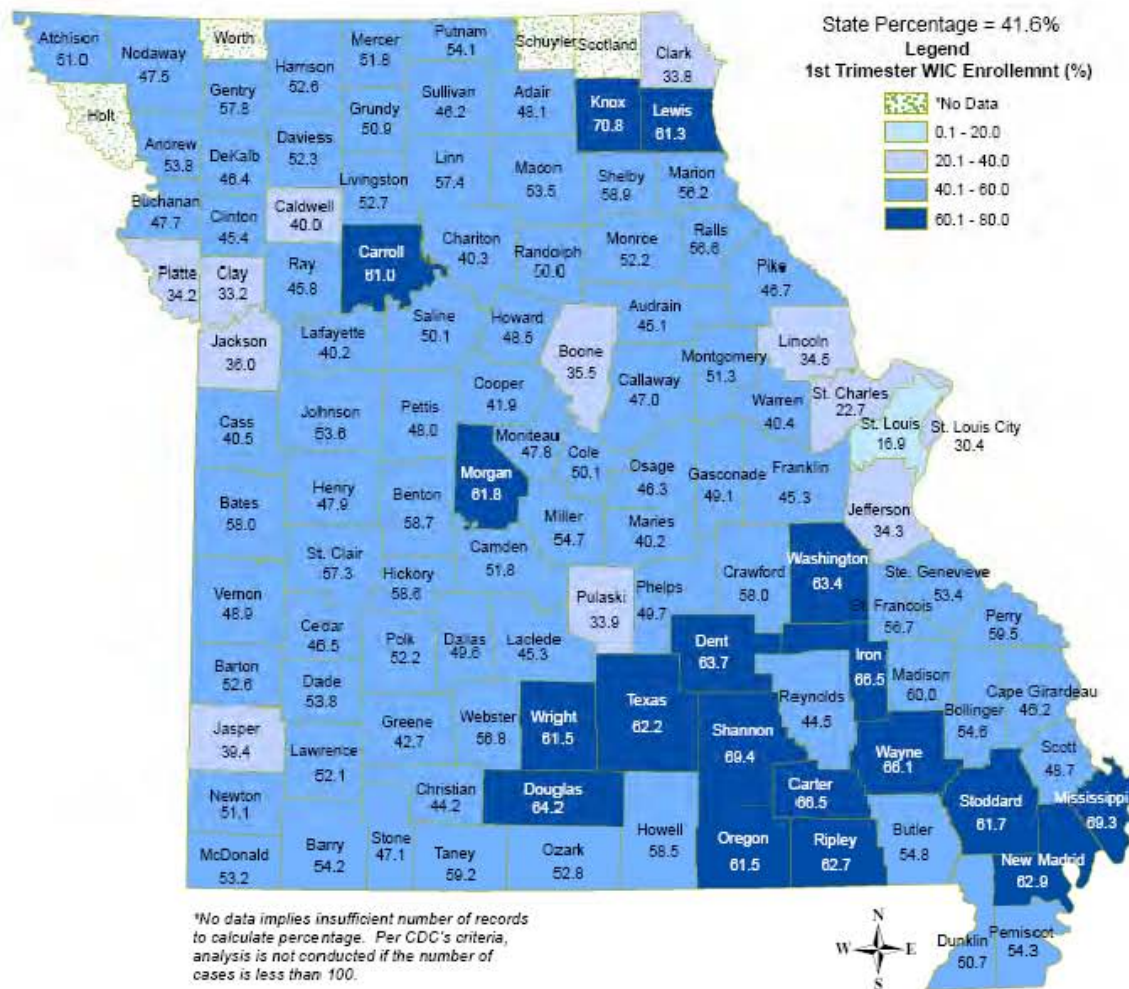
**Percentage of WIC Women Who Had No Medical Care During Pregnancy  
by County, Missouri PNSS 2004-2006 Combined Years**





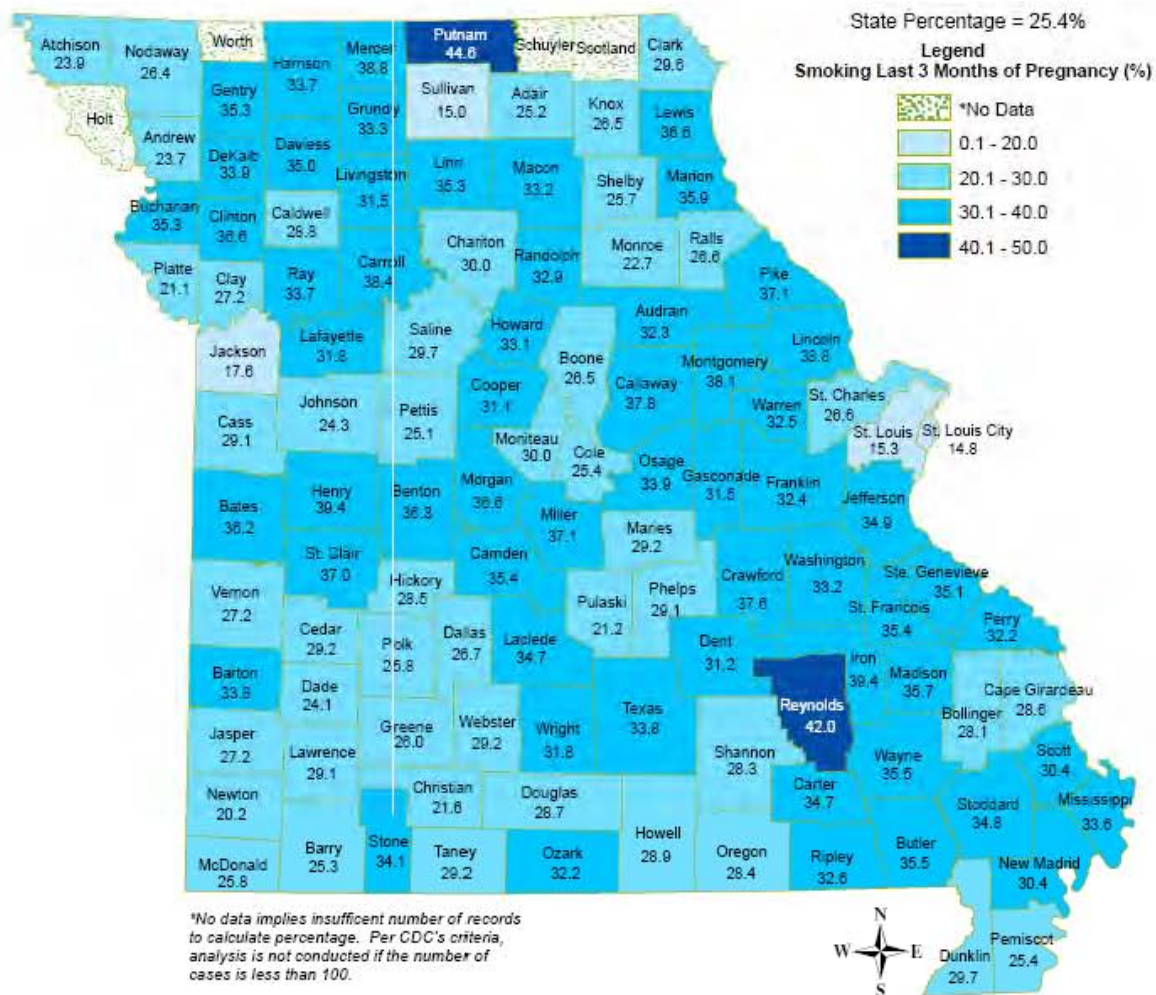
Appendix 7

**Percentage of Women Enrolled in WIC During the First Trimester of Pregnancy by County, Missouri PNSS 2004-2006 Combined Years**



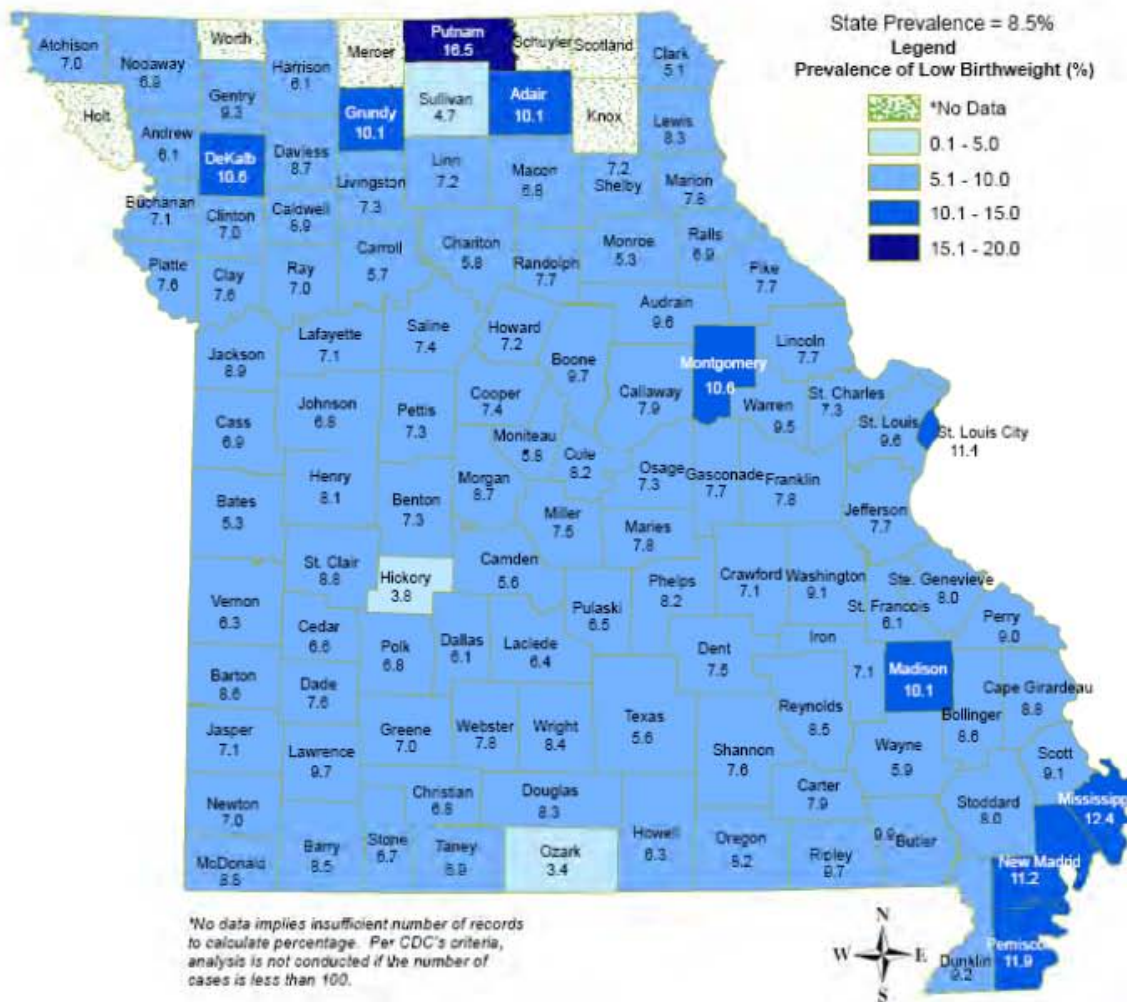
# Appendix 8

**Percentage of Women Who Smoked During the Last Three Months of Pregnancy by County, Missouri PNSS 2004-2006 Combined Years**



# Appendix 9

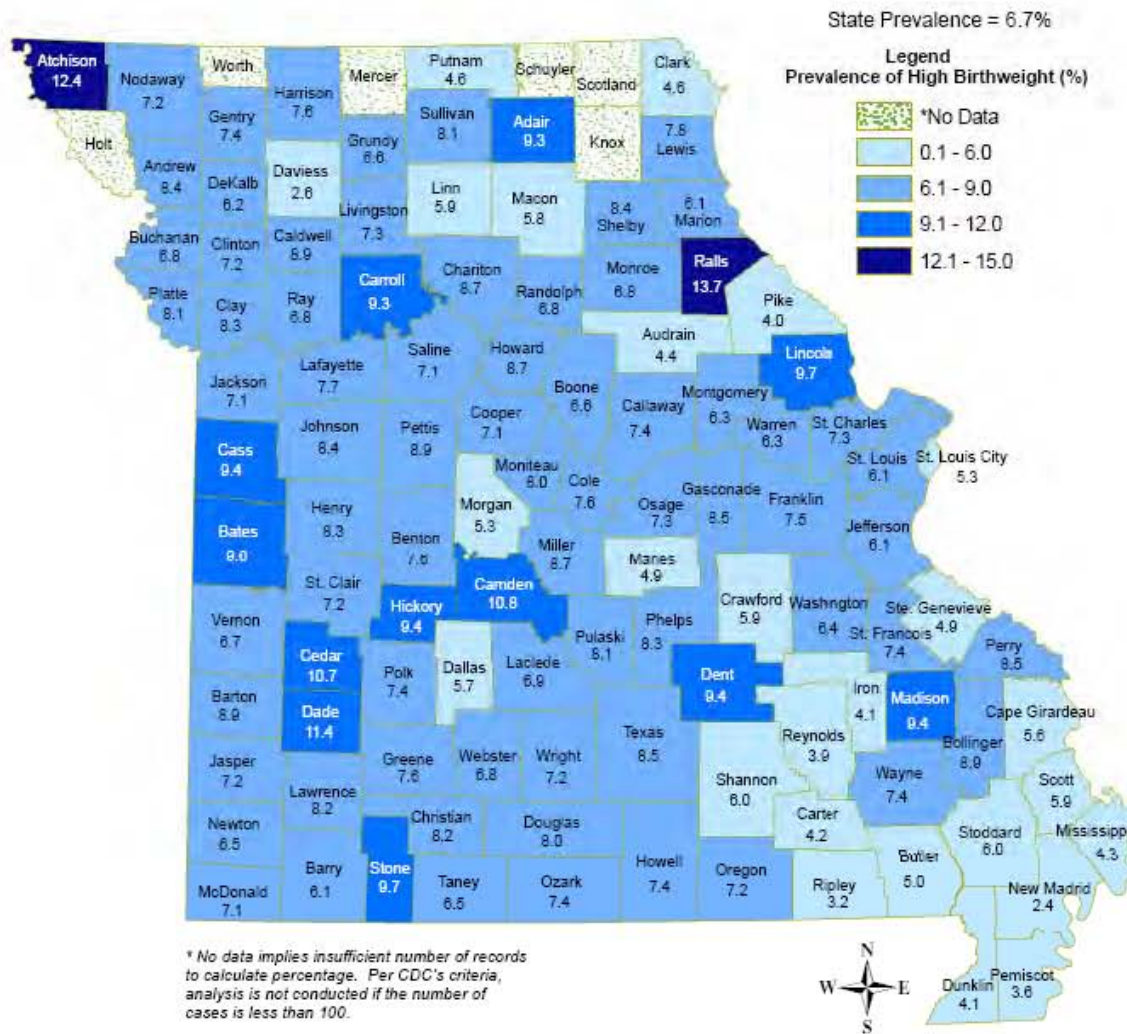
**Prevalence of Low Birthweight by County,  
Missouri PNSS 2004-2006 Combined Years**





Appendix 10

**Prevalence of High Birthweight by County,  
Missouri PNSS 2004-2006 Combined Years**





## Appendix 12

Percentage of Breastfeeding Initiation by County,  
Missouri PNSS 2004-2006 Combined Years

